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Water Quality Studies at Cougar Lake, Blue River Lake, and the McKenzie River, Oregon

John J. Hains

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Water Quality Studies at Cougar Lake, Blue River Lake, and the McKenzie River, Oregon

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Preface

The work described herein was conducted under a Military Interdepartmental Purchase Request by the U.S. Army Engineer Research and Development Center (ERDC), Waterways Experiment Station (WES), Vicksburg, MS, for the U.S. Army Engineer District, Portland (NPP).

This report was prepared by Dr. John J. Hains, Environmental Processes and Effects Division (EPED), Environmental Laboratory (EL), WES. Dr. Robert H. Kennedy and Mr. Steven Ashby, EPED, WES; Mr. Ken Dunn, ASci Corp., Mr. James Britton, Ms. Nicole Flint, Messrs. Michael Posovich and George Kalli, CENPP-PE-HR, provided assistance with field sampling. Dr. Patrick Howle, ASci Corp., and Mr. Van Garner, University of Georgia, performed laboratory analyses. Ms. Heather Rice, EPED, EL, WES, assisted with the data entry for this study.

In addition, field sampling was greatly facilitated by the gracious assistance from personnel at Cougar Dam Project. Messrs. Lester E. Schmig, Bruce S. McClamroch, Doug W. Esch, Wesley Hively, and Christopher Taylor provided an invaluable resource during this work, taking great care and effort to ensure its successful and safe completion.

Accommodations during much of this work were provided by the H. J. Andrews Experimental Forest Research Facility located adjacent to Blue River Lake.

The work was performed under the general supervision of Dr. Richard E. Price, Acting Chief, EPED, EL; and Dr. Phil G. Combs, Chief, Hydraulic Structures Division (HSD), Coastal and Hydraulics Laboratory (CHL); Dr. John W. Keeley, Director, EL; and Dr. James R. Houston, Director, CHL.

At the time of publication of this report, Dr. Lewis E. Link was Acting Director of ERDC, and COL Robin R. Cababa, EN, was Commander.

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Executive Summary

Blue River and Cougar Reservoirs are proposed for modification to their withdrawal structures to allow selective withdrawal. The purpose of the proposed modifications is to improve downstream temperatures for the coldwater fishery in the McKenzie River. The Corps committed to study water quality at the reservoirs in order to predict downstream impacts to water quality in the McKenzie River as a result of selective withdrawal.

Proposed modifications to the project structures at Blue River and Cougar Lakes will result in release of warmer surface water during the spring and summer. Assuming that the current limnological structure of the lake is maintained, the present absence of strong chemical trends is unlikely to result in future increases in outflow chemical concentrations. Indeed, turbid releases may be decreased or postponed until later in the season during the release of the deeper water. The chemical trends that exist tend toward greater concentrations with depth. Surface releases may improve the water quality in those outflows.

Under current conditions, the forms of organic carbon measured in this study will not likely be altered in the outflows as a result of proposed modifications. If surface waters were selectively released, under current conditions outflows would likely contain chlorophyll biomass. The peak of this biomass would occur during May or June and decrease later in the summer. There is apparently no effect of this bloom on the TOC and DOC trends observed in the lakes or on downstream TOC and DOC concentrations. Future effects will depend on algal growth rates, intake depth, and hydraulic retention time for those depths associated with algal populations and the releases.

Proposed modifications will alter the processes contributing to many of the above conditions. The limiting resource for much of the biological activity is the element nitrogen (N) which is also important for many other limnological characteristics. Because of its biological importance, nitrogen metabolism in this system is also important to the water quality effects of the proposed structural modifications.

Nitrogen (N) concentrations were often less than phosphorus (P) for free ionic forms (NH_3 and NO_3). Ammonia (NH_3) was undetectable in many samples early in the season. Later, in deeper waters, this form of N was detected at concentrations greater than 0.03 mg/l. This was especially true for Cougar Lake in which late summer maxima for this ion were observed at intermediate depths (30-50 m) with less concentration at shallower and greater depths. Stream stations had measurable concentrations but no consistent patterns for NH_3 .

Concentrations of NO_3 were less than 0.03 mg/l for most samples through April and May. However, on 23 July, NO_3 in Cougar Lake increased to 0.052 mg/l at the lake bottom. By August and September the bottom of Cougar Lake contained greater than 0.1 mg/l NO_3 . A similar trend was observed in Blue River Lake but final concentrations did not exceed 0.1 mg/l NO_3 . Stream stations continued to have low concentrations of NO_3 except for reservoir outflows which approached 0.05 mg/l NO_3 . The McKenzie River was not obviously affected by these trends and maintained concentrations of less than 0.01 mg/l for most samples.

The materially combined forms of N, TN and TSN, were always greater than dissolved forms. Digested sample analyses yielded highly variable results and no obvious trends were found except that stream samples often contained greater concentrations of these nutrients.

Concentrations of P in the streams had a very consistent pattern with the greatest concentrations occurring in the McKenzie River upstream of the confluence of the outflows of Blue River and Cougar Lakes. There was consistently a pattern of decrease of concentration downstream which can be explained by either dilution or uptake by biota.

Water quality concerns which remain regarding the proposed structural modifications are:

1. the unknown extent to which additional particulate organic material may be released from the lakes,
2. the late summer fate of accumulated nutrients in the hypolimnion of the lakes,
3. and the additional changes which may occur as a result of increased retention of deeper waters, the turbid materials they contain, the increased hypoxia that can occur, and the potential response of biota when these become available during mixing or during late-summer releases.

Although these concerns remain, factors that may mitigate their effect include the fact that much of this response will occur during the late summer when the lake is drawn down and depending on intake design, such waters may be diminished during drawdown. The maximum extent to which these processes may occur does not likely exceed the observed present deep hypolimnion conditions in Cougar Lake. Indeed the submerged ridge associated with Rush Creek currently provides a model of the likely behavior of Cougar Lake after modification and further changes in water quality as a result of intake modifications may be quite small.

CONVERSION FACTORS, NON-SI TO SI (Metric) UNITS OF MEASUREMENT

Non-SI units of measurement used in this report may be converted to SI units as follows:

Multiply	By	To Obtain
feet	0.3048	meters
meters	3.281	feet
Fahrenheit temperature	5/9 after subtracting 32	Celcius temperature
Celsius temperature	9/5 and add 32	Fahrenheit temperature
cubic feet	0.02831685	cubic meters
cubic meters	35.289	cubic feet
acres	0.405	hectares
hectares	2.47	acres
miles	1.609344	kilometers
kilometers	0.62	miles
square miles	2.59	square kilometers
square kilometers	0.3861	square miles
gallons	3.785	liters
liters	0.264201	gallons
pounds	0.454	kilograms
kilograms	2.2046	pounds

INTRODUCTION

The Willamette River Basin is an area of interest with respect to a variety of issues because of its proximity to the large urban area of Portland, OR and because it drains an important region of agriculture, industry, and commerce. Issues such as water quality or flood control are related to watershed processes or practices and because of this, tributaries to the Willamette River are also of interest with respect to these water resource issues.

Many of the tributaries to the Willamette River have been impounded, primarily for the purpose of controlling flows in the Willamette River. One such tributary, the McKenzie River, is diagrammed in Figure 1 showing the hydrologic complex of tributaries, dams, lakes, and diversions in the McKenzie River Basin. Cougar and Blue River Lakes are Corps impoundments of tributaries to the McKenzie River. These lakes were authorized by the Flood Control Act of 1938 (Public Law 75-761) as part of a "general comprehensive plan for flood control, navigation, and other purposes.." The Willamette projects are operated for the multiple purposes of flood control, power generation, navigation, and irrigation. Additional "secondary" purposes have been added by legislation and policy. These additional purposes include recreation, fish and wildlife conservation, and pollution abatement. Summer conservation operation of this system helps meet minimum flows, power generation, irrigation, navigation, recreation, instream flows for fish, water quality, and municipal and industrial needs. The water of Cougar and Blue River Lakes is released first to meet conservation needs but the other authorized purposes also apply to both of these lakes.

Cougar Dam was completed in 1963 and formed Cougar Lake (Figure 2). Blue River Dam was completed in 1968 and formed Blue River Lake (Figure 3). Cougar and Blue River Lakes are of similar size but Cougar is much deeper and has a hydroelectric generation plant in addition to providing flood control capacity. Blue River Lake provides flood control capacity but does not provide hydroelectric generation although such development was authorized and is possible in the future for Blue River Dam.

The impoundment of Cougar and Blue River Lakes in the 1960's had unanticipated consequences on the thermal patterns in the McKenzie River. After these two lakes were completed the McKenzie River downstream from these lakes experienced delayed warming in the spring and delayed cooling in the fall of each year. The fish populations of this system were not adapted to this thermal pattern and the modification of the thermal properties of the McKenzie River had an adverse impact on those fisheries.

Figure 4 (taken from USGS data) illustrates the effect of impoundment on thermal patterns in the McKenzie River. Prior to the formation of these lakes, the McKenzie attained a temperature of 10°C (50°F) in late May. After impoundment the river did not attain this temperature until August. In these comparisons, 10°C was chosen because of its importance as a thermal limit to salmonid habitat. Attaining temperatures greater than 10°C in the spring are important to the timing of upstream migration as well as for the early development of eggs and fry. After impoundment, the maintenance of cooler water temperatures through much of the summer diminished normal migration and spawning upstream of Leaburg Dam on the McKenzie River. During July and early August, the maximum thermal difference between pre- and post-impoundment was approximately 14°C.

In the fall the impoundments effectively increased temperatures in the McKenzie River although the increase over pre-impoundment conditions was small in comparison to the cooling effect earlier in the summer. The fall increase, however, speeds the maturity of downstream eggs and fry causing them to migrate downstream under seasonal conditions for which they are not adapted.

Reservoir operation and location of water outlets are relevant to the explanation for these post-impoundment thermal effects. In the spring, the reservoirs are filled (Figure 5) by decreasing the outflows (Figure 6). This causes colder water to accumulate in the filling lakes at the greatest depths and near the outlets. Therefore during late spring and summer, water released from the lakes is colder than expected for the streams. In the fall, when the reservoirs are drawn down (Figure 5) and outflows are increased (Figure 6), warmer surface waters reach the outlets. At this time warmer water is released from the lakes (Figures 7 and 8). Reservoir operation, location of withdrawal outlets, and seasonal thermal inputs, taken together, explain the release of cooler water in summer, of warmer water in the fall, and the associated downstream impacts to fish.

Thermal changes within the McKenzie River system impacted both resident and anadromous species of fish. Special concerns were raised with regard to certain species such as bull trout and the Willamette spring chinook salmon. A Draft Feasibility Report and Environmental Impact Statement (EIS) of potential modifications to Cougar and Blue River projects was completed in 1994 (USACE-NPP 1994). This report detailed the impacts to biota and proposed alterations to these projects. In conjunction with the EIS, an exhaustive study of thermal dynamics of the McKenzie River was completed and updated in 1994 (USACE-HEC 1994).

Of the proposed alternatives, selective withdrawal was considered an effective means of managing water temperatures in reservoir releases. Selective withdrawal through structural modifications at Blue River and Cougar projects was one alternative considered as a means of returning the thermal patterns of the McKenzie River to approximately pre-impoundment characteristics.

Selective withdrawal allows water to be released from specific depths in order to achieve water quality goals. However, the water that is released for one characteristic brings with it the other limnological characteristics present at that depth. If opposite depth-dependent water quality trends are present in a lake, selective withdrawal decisions must consider competing water quality trends. If Blue River and Cougar Lakes contain greater concentrations in the warmer surface waters of substances that may impact certain types of use, then the selective withdrawal option for temperature management must consider those materials as an additional water quality issue.

The Eugene Water and Electric Board expressed such concerns in their letter response which was contained in an appendix to the EIS. The concerns were:

1. Turbidity changes due to surface withdrawal
2. Increased demand for dissolved oxygen (either biological or chemical)
3. Algal biomass as a source of taste or odor problems
4. Increased organic loading as potential precursors to the formation of trihalomethanes or haloacetic acids in finished water.

These concerns were posed as potential risks to the drinking water supply and the last of these was the greatest concern. Formation of halogenated hydrocarbons in significant concentrations would require expensive treatment options.

Study Goals

This study was designed to accomplish the following goals:

1. to describe the current general limnological conditions in Blue River and Cougar Lakes and the McKenzie River as they compare to recent similar studies;
2. to identify the chemical structure, if any, that exists in the two lakes and the chemical trends in the McKenzie River;
3. to describe the specific trends of dissolved organic carbon within this system;
4. to identify the distributions of algal biomass in the system as it may relate to chemical composition in the water.
5. to identify potential impacts to water quality in the McKenzie River as a result of the proposed structural and operational modifications.

Study Rationale

The goals of the study were addressed by performing a comprehensive limnological survey of the lakes as well as the McKenzie River downstream from the lakes. These results either provided the first descriptions of previously unknown characteristics or they provided the basis for comparison with previous studies.

Because the characteristics of interest were expected to occur primarily during the summer season, and because maximum pool elevation occurs during that season, approximately monthly surveys were performed from April through September 1996. The study methods were partitioned into three efforts. The first was to complete *in situ* surveys of field-measurable parameters. These were collected and used for subsequent water sampling prior to their entry into the database. The second method employed water sampling followed by subsequent chemical analysis for basic chemical parameters important for plant growth, important as potential contaminants, important as sources of downstream loading, or important to other processes in the lakes. The third method examined directly the trends of algal distributions in the lakes on the assumption that chemical gradients may be related to the algal distributions.

Site Description

The McKenzie River has its source at Clear Lake at RM 89.6 and flows southwards approximately 15 miles before flowing westward at approximately 44° N latitude for an additional 75 miles to the Willamette River. Approximately 70-80% of annual precipitation occurs during October through April. Precipitation is variable and is maximum at higher elevations (up to 110 inches in the Blue River drainage).

Soils in this system are derived from an underlying base which consists primarily of pyroclastics, andesite intrusives, and contact breccias. The foundation rock at Cougar Dam is primarily basalt. At Blue River Dam the foundation rock is primarily andesite.

The waters entering Cougar and Blue River during base flow are clear and dilute. Nutrient concentrations are often near detection limits in waters draining these soils. This is especially true for the element nitrogen (N) which is considered a limiting nutrient in these waters.

The seasonal precipitation pattern that Cougar and Blue River Lakes were designed to moderate produces frequent high flow events. Such an event occurred just prior to this study. Figures 9 and 10 show the hydrologic history for these two lakes beginning 1 January 1996 and continuing through the duration of the study. These figures clearly show the high flow event in February 1996. They also demonstrate that there are other lesser events that may also provide frequent high flows and inputs of materials to these lakes. Inflows to the lakes are characteristic of their respective basins and exhibit some variation in their content. This study assessed only the major inflows on each lake.

Cougar Dam was constructed 7.2 km upstream from the McKenzie River on the South Fork McKenzie River. It is a rock-fill embankment and is approximately 138 meters high from average tailwater to the crest of the dam. Cougar Dam was completed and began operation in 1963. The South Fork McKenzie River enters the McKenzie River at RM 59.7. Upstream from Cougar Lake the South Fork McKenzie River is the largest single inflow. The major physical features of Cougar Lake are listed in Table 1.

Blue River Dam was constructed 2.9 km upstream from the McKenzie River on the Blue River. It is an earth-and-rockfill embankment and is approximately 82 meters high. Blue River Dam began operation in 1968. The Blue River enters the McKenzie River at RM 57.0. Upstream from Blue River Lake the Blue River and Lookout Creek are the two largest inflows. During the flood event in February 1996 Lookout Creek was altered and it will have a new rating for the purposes of calculating flows since that event. The major physical features of Blue River Lake are also listed in Table 1.

MATERIALS AND METHODS

Sample Locations

Sample locations were selected in order to accurately characterize the limnological status of the lakes and to provide information for the prediction of material distributions within the lakes and the McKenzie River Basin. Table 2 lists the sample stations, their abbreviations, and locations. Four sample sites each were selected in Blue River and Cougar Lakes. These corresponded to the deepest locations near the dams and three approximately equally spaced locations upstream in each lake (Figures 2 and 3). The deepest station was designated as station 1 and used for all chemical sampling in each lake. The three additional stations were selected to provide spatial detail for those limnological parameters that could be measured *in situ*.

Stream sample locations were selected to characterize the waters flowing into the lakes, exiting the lakes, and in the McKenzie River downstream to Hayden Bridge. Both water chemical samples and *in situ* measurements were taken at all stream sample stations.

Inflow stations (SF-IN, LC, and BR-IN) were selected to provide data on stream characteristics prior to entering the lakes. Lake stations (CR and BR #'s 1-4) were selected to characterize the lakes and dam outflow stations (BR-OUT and CR-OUT) were selected to provide data on water quality of the outflows. One station on the McKenzie River (MR-UP) was selected upstream from the confluence of the South Fork McKenzie River and the Blue River in order to characterize the McKenzie River prior to any influence by the dam outflows. Another station on the McKenzie River was selected just downstream from that confluence at Finn Rock (MR-FR). Leaburg Dam is an important feature for this system because the Leaburg Canal which exits the river at that location as well as the fish hatchery which is also located just downstream from the dam. A sampling station was selected at the Leaburg Dam (MR-LD) to characterize the water quality of its outflows. Another station was selected just after the Walterville Canal exits the McKenzie River at a USGS gaging station (MR-GS). This site is intermediate between Leaburg Dam and Hayden Bridge. At Hayden Bridge a sampling station (MR-HB) was selected at the water intake for the Eugene Water and Electric Board (EWEB) pumping station.

Lake *In situ* Methods

Temperature, dissolved oxygen, pH and specific conductance were measured *in situ* at designated stations along the main stem of the McKenzie River, in Blue River and Cougar Lakes, and in major tributaries to each lake (Figures 1, 2, and 3). Stream stations were sampled by collecting water in two clean, rinsed buckets. One bucket was reserved for chemical samples and the other was used to immerse the *in situ* limnological survey equipment. In the lakes, measurements were taken at two-meter intervals from the surface to a depth of 50 meters and then at five-meter intervals to one-half meter above bottom. On some occasions the depth interval was two meters from surface to bottom.

Additional temperature data was collected in Cougar Lake using continuous monitoring techniques. Stowaway® instruments, capable of logging thermal data continuously at discrete depths and time intervals, were deployed at the deepest location on Cougar Lake by personnel from Portland District. These were deployed prior to the beginning of this study at depths chosen to best characterize the summer temperature trends of Cougar Lake. The instruments were physically attached to a cable suspended vertically in the water column. At the end of the deployment period, the cable and attached loggers were retrieved from the lake. Later the loggers were downloaded to a computer and the thermal

data from individual loggers was associated with the appropriate depth in the final database. The resultant data was used in this study to depict the thermal history of Cougar Lake.

Field limnological survey equipment (Hydrolab H20) was employed for *in situ* measurements. The instrument was calibrated in a manner which conformed to Standard Methods (APHA 1992). Temperature was calibrated against a standard thermometer related to an NBS standard. Dissolved oxygen was calibrated against air saturation or the result of a Winkler titration prior to transport. Prepared known chemical standards were used for pH calibrations and for conductivity. Depth was calibrated at the water surface and checked against known depth marks on the cable.

In situ data was recorded on standard data forms and returned to Trotters Shoals Limnological Research Facility (TSLRF) for entry into the database. A draft of the entered data was checked by a third party against the original field sheets in order to detect any entry errors. This draft was returned for correction and the 'proofing' procedure was repeated until no additional typographical errors could be detected. Once in the database, an error checking program was finally employed to detect any errors that remained. The database was updated with each new data addition.

Field chemical analyses were performed on samples from Cougar Lake, Blue River Lake, their tributaries, and the McKenzie River. When possible, the sampling effort was completed in one day for each lake. The field surveys of the McKenzie River were scheduled in a manner which gave priority to the more demanding schedules for Cougar and Blue River Lakes. If possible, biological sampling was completed in conjunction with the limnological sampling.

Water samples for chemical analyses were collected as whole water or the product of field filtrations. Water was usually collected through a hose which was marked for depths. The hose end was connected to a weighted intake in order to maintain an extended configuration and proper depth. Water was pumped using a diaphragm pump through a manifold capable of delivering the samples through attached filter holders. Each sample was taken after the pump had cleared the hose of water from previous depths. This was accomplished by measuring the travel time through the hose and waiting twice that time after repositioning to the next depth. Samples were collected at 10m intervals in the lakes. Based on examination of the *in situ* profiles, another sample was occasionally collected at an intermediate depth corresponding to the thermocline or at a depth of rapid dissolved oxygen change. Samples were labeled with waterproof labels which identified the station, depth, date, time and type of analysis.

Chlorophyll samples were collected as whole water and filtered in the laboratory using glass fiber filters (Gelman type A/E). Dissolved organic carbon samples were also collected by filtration through the glass fiber filters after they were thoroughly rinsed with sample water to remove any residual organics on the filters. The filters for organic carbon sample filtrations were pre-treated by baking them for one hour at 400°C in a muffle furnace to combust any associated organic carbon. This pre-treatment was performed by the manufacturer and specified for this sampling in order to diminish potential background contaminants. Samples for total content analyses were collected as unfiltered, whole water. Field filtrations were performed for chemical analyses of dissolved substances. These filtrations were performed using either a field filtration manifold with pressure supplied by a pump or a filter flask and a hand vacuum pump. Filtered water for chemical analysis was collected by filtration through a 0.45 µm membrane filter. Each sample was collected into chemically cleaned containers rinsed in the field with the sample water to be collected. Additional samples were taken for quality control (QC) purposes. The stations and depths of these QC samples were subjectively distributed throughout the sampling effort to encompass the full time and range of field sampling activity. Because the analyses were performed in

conjunction with samples from other lakes for other projects, the combined QC results were used for the studies on Cougar and Blue River Lakes and the McKenzie River.

Field measurements of in vivo fluorescence were made using a Turner Designs field fluorometer that had been configured to examine chlorophyll fluorescence. After the chemical samples had been collected the pump hose was connected in-line with the fluorometer. Filtered water collected from 50m and 10m depths was then pumped through the fluorometer to determine the background fluorescence in the water for depths in the photic zone and deeper depths. Water at each depth was then pumped through the fluorometer and readings of fluorescence units were made at each depth as estimates of the distribution of chlorophyll fluorescence. Once the fluorescence readings were corrected for background fluorescence, the measurements were compared against extracted chlorophyll concentrations at those depths where the two methods were coincidental. This procedure enabled assessment of much finer scale of chlorophyll distribution in the lakes than standard assessment procedures would allow.

Additional samples were collected for phytoplankton enumeration. At least 500 ml was collected and returned to the field lab for preservation. These samples were preserved with a final concentration of approximately 2% glutaraldehyde. Some duplicate samples were preserved with Lugol's solution for purposes of comparison and quality control. Microscopic counts were completed at 500X magnification using techniques of settling, concentration, and enumeration in a Palmer nanoplankton counting chamber (APHA 1992). Identifications to major class were made using phase contrast illumination on a Zeiss Photomicroscope I equipped with a water immersion objective designed for this purpose. At least 500 cells were enumerated for the dominant taxon. If other taxa were sufficiently numerous they were counted separately. However, because the assemblage was vastly dominated by cyanobacteria, mostly *Anabaena*, the count data for that taxon was the only fraction which had statistical reliability. Other taxa were noted but the estimates of their population densities were not considered statistically accurate.

Results of the completed analyses were compiled into spreadsheet tables and transported to the database where the database was updated to incorporate the most recent entries.

Chemical Methods

Various sized sample containers were used to collect field water samples destined for analysis in the laboratory. Samples were transported and stored in coolers to control their thermal conditions as much as possible. Ice was used when necessary. Samples were transported to the field laboratory on the day they were collected and shipped to the analytical laboratory for analysis within 48 hours of collection.

All samples were collected in laboratory-prepared bottles. Bottle preparation consisted of standard acid cleaning (APHA 1992), except for chlorophyll, alkalinity, turbidity and biological sample bottles. Samples for nutrient and metal analyses were collected in acid-washed, clear high-density polyethylene (HDPE) bottles. Samples for carbon analyses were collected in acid-washed, rinsed glass bottles with teflon-lined caps. Acid-washed brown HDPE bottles were used for turbidity samples. Chlorophyll, alkalinity and biological samples were collected in tap water rinsed clear HDPE bottles. Care was taken to minimize agitation of turbidity and alkalinity samples at all times. Metal samples were preserved in the lab by acidification with nitric acid to pH<2.

Laboratory water used for analyses was produced either by distillation (Model THREE LITER, Corning Glass Works, Corning, NY) or by ultrapurification (E-pure®, Barnstead, Dubuque, IA). E-pure® water provided Type 1 Reagent Grade Water (RGW) per ASTM-D1193, NCCLS-ASC-3 and CAP. All

reagents and chemicals were grade certified. Standards were primary standards or traceable to NBS standards. All glassware and most plasticware was acid-washed in 10% hydrochloric acid, followed by three rinses with >8 megohm water (SYBRON/Barnstead, Barnstead, Dubuque, IA).

Analytical QC was maintained in three ways:

- 1) analysis of split and replicate samples;
- 2) analysis of spiked samples; and
- 3) analysis of blind quality assurance (QA) samples.

Split and replicate samples provided a means to estimate intrinsic variabilities due to laboratory and field sampling errors, respectively. A coefficient of variation (CV) was calculated for each parameter at each sampling period. A mean CV across time for each parameter was tabulated (Table 3). These means represent relative sampling precision and provide a way to compare different analytical procedures.

In-house spikes and blind QA samples (Analytical Products Group, Inc., Belpre, OH) provided a measure of laboratory accuracy. Spikes were prepared for each parameter from four selected stations during each sample run. The value derived by comparing a spiked to an unspiked sample was used to calculate a percent recovery based on the actual spike addition. The results from the blind QA samples were also reported as percent recovery. Both are summarized in Table 4.

Total (T) and total soluble (TS) nutrients were determined using the same preparation sequence. All samples were treated with persulfate digestion (APHA 4500-P B, 5) to convert phosphorus (P) containing compounds to orthophosphate. Samples were stored at room temperature until assayed. TP and TSP were determined by the ascorbate method as described in APHA 4500-PE. Soluble reactive phosphorus (SRP) reacts with molybdate and antimony ions in the presence of ascorbic acid to form a blue color. This phosphomolybdate complex was read at 880 nm on a Technicon™ AutoAnalyzer™ II.

Following TP and TSP analyses, samples underwent Devarda alloy reduction (Raveh and Avnimelech, 1979) in which available nitrogen (N) was reduced to ammonia. TN and TSN were determined by the salicylate method as described in Technicon™ Industrial Method N. 329-74W/B (revised 11/78). The reaction of ammonia with alkaline buffered (pH 12.8-13.0) salicylate/nitroprusside/hypochlorite solution produced an emerald-green ammonia-salicylate complex which was read at 660 nm on a Technicon™ AutoAnalyzer™ II.

The metals iron (Fe) and manganese (Mn) were determined by the direct air-acetylene flame method (APHA 3111 B; APHA 3500-Fe A, B; APHA 3500-Mg A, B) on a Perkin-Elmer 4000 atomic absorption spectrophotometer. Dissolved metals were assayed directly from field sample bottles, while total metals were digested in a CEM MDS-2100 microwave (USEPA, 1986) prior to analysis. Analyses of calcium, magnesium, sodium, and potassium were performed on a Dionex DX-300 ion chromatograph with a cation column.

Soluble nutrient (nitrate, nitrite, SRP, and sulfate) concentrations were determined by chromatography on a Dionex DX-300 ion chromatograph with chemical suppression of eluent conductivity (APHA 4110 B).

Pigments were measured on dimethyl formamide extracts (Hains, 1985) using a Shimadzu UV-2101PC UV-VIS scanning spectrophotometer.

Total alkalinity was determined by the titration method (APHA 2320 B) with a Beckman analog pH meter.

Total organic carbon was determined by the combustion infrared method (APHA 5310 B using a Shimadzu TOC 5000 carbon analyzer. This instrument was capable of measuring organic carbon concentrations three orders of magnitude less than commonly observed in surface waters. The concentrations encountered in the McKenzie River system were similar to other waters studied by TSLRF and no analytical modifications were necessary to accomodate lower limits of detection.

Turbidity was determined by the nephelometric method (APHA 2130 B) on a HACH Model 2100 turbidimeter.

RESULTS AND DISCUSSION

The surveys on Cougar and Blue River Lakes display similarities to the earlier studies of thermal trends. Stratification progressed through the spring as the surface elevation increased. The lakes filled with cold meltwater and the summer heating primarily affected the lake surface depths. In 1996, the thermal data logged continuously (Figures 11 and 12) show a common pattern of summer warming followed by fall cooling and mixing. This process is compounded by the continued withdrawal and drawdown according to the operational curve.

The hydrology of the two lakes is determined by the inflow trends against which a standard operational surface elevation is maintained. Early in the spring an unusual inflow event caused rapid filling of each of the lakes. Although the subsequent drawdown brought the surface elevation to standard, the magnitude of the inflows may be relevant to the substances suspended or dissolved in these waters later in the year. As shown later, this may be of particular relevance to turbidity in Blue River Lake.

Thermal Results

Temperatures at the lake surfaces varied in these surveys from a minimum of approximately 5°C to a maximum of approximately 23°C. The earliest survey in April showed the minimum stratification although by that time, stratification had developed in both lakes. In April a thermal gradient of approximately 6°C had developed between the surface and bottom. The presence of stratification is important because the development of chemical or biological gradients depends upon the temperature/density gradients and the length of time these gradients exist.

Figure 11 shows the seasonal pattern expected for these monomictic lakes which occur at a latitude of approximately 44°N. Stratification begins each spring and can be observed in thermal profiles by April. However, a strong thermocline does not develop until later in the summer and this was observed in July - September 1996. Figure 12 shows each of the summer months as separate panels in order to depict the process in which surface warming affects deeper waters through time. The effect of diel warming and cooling is also evident in this figure. Close examination of the figure shows an "undulation" of the surface temperatures that coincides with diurnal warming and nocturnal cooling for most of these summer days. The daily pattern only affects the surface few meters of the lakes but is important in helping determine the depth of the thermocline and is potentially important in determining the distribution of materials in those surface depths.

There were no releases from shallow depths for Cougar and Blue River Lakes and the thermal patterns with depth are determined mostly by meteorological interactions during the summer season. Releases from deeper depths does affect the heat content of the lake by reducing the volume of colder water in each lake as the season progresses. As stated in the Introduction, this process is central to the concerns for these lakes and thermal aspects of this were exhaustively addressed by earlier studies (HEC, 1994).

Throughout the surveys, the deeper waters were much cooler than the surface. For example the deepest waters in Cougar Lake never exceeded approximately 5°C, slightly greater than the temperature of maximum density for water. At those temperatures, biological processes likely to consume dissolved oxygen proceed more slowly, even when substantial substrates are present.

Field Surveys - Blue River Lake

As much of the characterization of these lakes as possible (and the streams associated with them) was completed using field techniques and measurements. In addition to thermal measurements, field limnological surveys identified trends in the important parameters dissolved oxygen, pH, and conductivity. Figures 13 - 18 summarize the results of these surveys for Blue River Lake.

Of all the variables measured in the field, pH showed the least change. Dissolved oxygen had little variability in April (Figure 13) and in May (Figure 14) only showed a reduction to 8 mg/l near the lake bottom from a nominal 10-12 mg/l nearer the surface. Furthermore this decrease was observed only at station 3.

In July, dissolved oxygen concentrations were less throughout the water column but exceeded 8 mg/l at all depths (Figure 15). In July, an interesting metalimnetic maximum dissolved oxygen concentration was observed at approximately 8 m depth at most locations on the lake. There was also a measureable increase in pH where the dissolved oxygen maximum occurred suggesting that photosynthesis was at least partly responsible for these heterogeneities.

By August, the metalimnetic maximum had diminished and only a mixed heterograde pattern was observed for stations 1 and 2 (Figure 16). At that time pH had no observable structure. Maximum temperatures were observed in August. Temperatures attained nearly 23°C in the surface waters and accompanied a maximum overall gradient of approximately 13°C from surface to bottom. Dissolved oxygen showed a pattern of decrease near the bottom of the lake at station 2 and 3. Station 3 was nearly anoxic near the lake bottom.

In September, lake surface elevation had decreased and in spite of removing the cooler bottom waters to accomplish this, there was still a strong thermal gradient present at all but station 4 in Blue River Lake (Figure 17). At this time, pH had no discernable trend. Dissolved oxygen displayed a heterograde pattern at station 1 similar to the pattern observed in August. A decrease in dissolved oxygen concentration at depths near the thermocline was followed by an increase at immediately greater depths. At station 3 and nowhere else in the lake, dissolved oxygen decreased to anoxia at the lake bottom.

Because of the measuring device, field measurements of ionized materials dissolved in the water are expressed as specific conductance and because the machine does not have the capability to separate the measures, this study uses the term 'specific conductance' interchangeably with 'conductivity' which is correct where measurements have been standardized. Conductivity was variable at most times and locations in Blue River Lake. Conductivities varied from approximately 24 - 32 μ S throughout the lake at most times (Figure 18). However, the variation observed was over a small value range and did not likely represent an important trend. The only exceptions occurred at the thermocline (approximately 8m) in July and at station 3 in May, August and September. In early July, conductivity increased visibly at all sampling stations at depths near the thermocline. This observation coincided with increases in dissolved oxygen and pH and likely was a response to increased biological activity at those depths. Station 3 displayed another trend in which conductivity increased near the lake bottom and its coincidence with decreases in dissolved oxygen supports the hypothesis that more intense biological or chemical activity occurs near that station at the lake bottom. By September, the bottom conductivity had increased from approximately 35 to a maximum of greater than 60 μ S.

Field Surveys - Cougar Lake

Thermal trends in Cougar Lake were similar to those observed in Blue River Lake. The seasonal thermal trends in Cougar Lake have already been described and are depicted in Figures 11 and 12. However, the field surveys were able to provide finer depth resolution than the continuous loggers. Figures 19 and 20 show the initial thermal structure for April and May 1996. During this time at most locations there was one obvious thermocline and a similar gradient to that of Blue River Lake. However, at station 1 and 2 in May there was evidence of the formation of a multiple thermocline with a deeper thermocline occurring at approximately 50 m. A similar trend may also have been forming at station 3 indicating that the pattern was lakewide at 50 m depth. This pattern was obvious by July (Figure 21), and consistently occurred at the 50 - 60 m depth range. The pattern became less obvious in August because waters shallower than 50 m were warming by that time (Figure 22). In September the pattern persisted near 35 - 40 m depth because of the late-summer drawdown which had started by that time (Figure 23).

Cougar Dam has numerous structural features which make this lake more complex. The elevation of the deepest location (station 1) is approximately 1290 ft. This corresponds approximately to the location of the main diversion tunnel entrance. This tunnel did not release water during this study. Releases that did occur originated at approximately 1420 ft elevation. Between the deepest location and the penstock intake for Cougar Dam is a shallower crest at approximately 1525 ft elevation. It would not be incorrect to interpret this structural feature as a physical barrier to movements of waters in a thermally stratified lake at elevations less than 1525 ft. Although the intake for Cougar Dam was located at a deeper elevation of 1420 ft, the shallower crest at 1525 ft. may have restricted water movement at greater depths allowing warmer waters to be released than would have occurred were it not for the restriction. The depth of the secondary thermocline corresponds to the elevation of the crest which at maximum pool elevation is approximately 70 m shallower than station 1 and a little more than 50 m deep.

Dissolved oxygen showed more pronounced trends in Cougar Lake than had been observed in Blue River Lake. In April dissolved oxygen concentrations were nearly constant from surface to the bottom at most locations in Cougar Lake. There was a slight decline near the bottom at station 1 (Figure 19). In May (Figure 20) The oxygen concentrations in deeper waters remained nearly 12 mg/l for most depths but showed the beginning of a positive heterograde distribution at approximately 8 m depth. This corresponded with the shallow thermocline and coincided with an increase in pH at shallow depths in May. The positive heterograde pattern was very obvious in July with dissolved oxygen concentrations approaching 15 mg/l in the thermocline (Figure 21). However, this trend was stronger for the deepest stations and less obvious nearer the headwaters at station 4. In August (Figure 22) dissolved oxygen concentrations continued to show the heterograde pattern but also displayed an increase through a broad depth range at depths from 50 to 90 m. August dissolved oxygen also showed some decline near the bottom although minimum concentrations were usually greater than approximately 5 mg/l. In September the pattern had become less visible (Figure 23) perhaps due to the releases from the lake or to surface cooling and mixing. However, near the lake bottom, concentrations did decrease to less than 2 mg/l.

Specific conductance values were different in Cougar Lake compared to Blue River Lake. This is probably due to the fact that the South Fork McKenzie River has greater specific conductance than the major inflows to Blue River Lake. Patterns in conductivity were highly variable for most depths, times and locations (Figure 24). However, in July conductivity showed a different pattern in that values near the thermocline increased in comparison to other depths. Another pattern of increased conductivity was displayed at greater depths for that month as well as for August and September. Specific conductance is a measure of the ability of water to conduct electricity under standard temperature conditions. This parameter is influenced by the concentration of chemical ions in the water and the type of ions present. Any process that produces or consumes chemical ions causing a net increase or decrease of ion

concentration will change the conducting properties of the water. Photosynthesis may decrease nutrient ions or inorganic carbon producing a change in specific conductance. Respiration conversely may mineralize organic materials adding to the concentrations of chemical ions. In addition, if inflowing streams are of different specific conductance than the receiving body of water, the depth to which the inflows entrain will tend to reflect the conducting character of the inflows and shallower or deeper waters may retain the character of the lake. These and other processes pose difficulty for the interpretation of distributions of specific conductance and this measure is used most often as an indicator of biogeochemical activity or as a predictor for the concentrations of dissolved materials in the water (total dissolved solids).

Field Surveys - Streams and Rivers

Surveys of *in situ* characteristics were performed on inflows, outflows, and in the McKenzie River primarily in support of the chemical analyses. These surveys showed that thermal trends compared with previously described trends and that other *in situ* parameters were either normal or expected for these waters.

Temperatures were cooler in outflows from the dams and warmer in the streams as expected. Dissolved oxygen concentrations were close to saturation values dependent on temperature at all locations except the dam outflows. Dissolved oxygen in the outflows were related to the concentrations existing in the lakes at the depths of the intake. However, in most cases the outflows had greater dissolved oxygen than existed in the lake because of the aeration taking place in the tailrace where the samples were collected. There were no obvious trends for pH.

Specific conductance was the most interesting *in situ* parameter. Although specific conductance was nominal for all observations, ranging between 25 and 60 μS , there was a consistent pattern of greater values in the McKenzie River at all locations (Figure 25), and to a lesser extent the inflows. The outflow from the Blue River dam (BR-OUT) was consistently less than the other stations. Specific conductance values at that location were always less than 30 μS . In April and May the two inflows to Blue River Lake (BR-IN and LC) joined the outflow having the three lowest values.

During mid-summer, July and August, the Cougar Dam outflow (SF-OUT) was second least for specific conductance. This contrasted with the major inflow to that lake, the South Fork McKenzie River (SF-IN), which had the greatest or second greatest specific conductance for both of those months. During September and fall drawdown, the outflow from Cougar Dam began to resemble the inflow to that lake but they still were within the values observed for the McKenzie River (40 to 50 μS) at all locations.

The McKenzie River upstream from the confluence of the outflows from Cougar and Blue River Dams consistently had the greatest specific conductance. The decrease for this parameter seen downstream from the two projects is seen as the effect of dilution although the specific conductance tended to remain approximately the same farther downstream.

Analytical Parameters

Turbidity

Although turbidity is a crude measure of an optical effect of suspended materials in water, it is indicative of the presence of such materials. Turbidities were of minimal values at all locations, times, and depths with the exception of the deepest depths and the outflows from Blue River Lake (Figures 26 - 30). In Blue River Lake, turbidity was visually obvious in the outflows and numerically important in the

deeper waters which were the source for those outflows. Turbidities were also greater in the deepest waters for Cougar Lake, but at depths outside of the withdrawal zone for the penstock. The maximum value for turbidity was observed at 110 m depth in Cougar Lake (10.3 NTU).

For each month of sampling there was a pattern of turbidity distribution in both lakes in which the turbidity increased from surface to a maximum value near the bottom of the lake (Figures 26-30). Comparison of the values near the surface of each lake also showed that the surface waters became less turbid through the season and that bottom waters maintained greatest turbidity. However, because outflows released the turbid bottom waters from Blue River Lake, the turbidity near the bottom of Blue River Lake also diminished through the season. Cougar Lake, in spite of the existence of the most turbid waters in the deepest waters of either lake, had an intake at intermediate depth and released waters with less turbidity than did Blue River Lake. The two lakes, then, acted as reservoirs for the suspended materials in the inflows as well as the inflowing water. The outflow from Blue River Lake (BR-OUT) was positioned to allow the gradual release of these materials through the season while the intermediate depth of the intake on Cougar Lake did not allow the release (SF-OUT) of much of this material. Sediment trapping is a common feature of reservoirs and some reservoirs are constructed specifically for this purpose. Where turbidity is a product of materials suspended in inflows, and if there is no autochthonous source for the turbidity, adjusting the depth of the intake can often improve the turbid properties of releases. This may explain the differences observed between Blue River and Cougar Lakes.

Observations of turbidity for the stream stations further supported the observations in the lakes. In February, prior to the first sampling, both lakes were subject to a spring flood event with the greatest effect on Blue River. This event is evident in the hydrographic data and it moved great quantities of materials and debris into both lakes. This may have been the source of turbidity in the deepest waters of the two lakes. For the entire season the Blue River outflow (BR-OUT) consistently had the greatest turbidity of any stream station. In May (Figure 27) turbidity increased from 0.3 upstream from the project confluences to 2.0 NTU just downstream from the confluences at MR-FR. This was the maximum turbidity observed on the McKenzie River for any time or location. July turbidities for the stream stations (Figure 28) continued a similar pattern to that observed in May except that the McKenzie River upstream of the two reservoirs (MR-UP) had its maximum value (still less than 1 NTU). In August and September (Figures 29 and 30, respectively), the effect of outflows on the turbidity of the McKenzie River were less noticeable. However, upstream of the projects the McKenzie River (MR-UP) remained remarkably constant at approximately 0.3 NTU and just downstream of the confluence was usually the greatest of the remaining river stations but still less than 2.0 NTU. The consistently clearest stations were always upstream from the projects, either on the McKenzie River or the inflows (MR-UP, SF-IN, LC, and BR-IN). This may be due to the gradual release from deep intakes of turbid waters previously stored during high flow events or it may be due to additional turbid inputs from activities downstream in the McKenzie River watershed.

Water Chemistry

Organic Carbon

Of all the chemical analyses those for carbon are of greatest interest. Carbon was measured as two organic forms, total organic carbon (TOC) and dissolved organic carbon (DOC). TOC is the total of all organic forms of carbon whether dissolved or particulate. DOC is operationally defined as organic carbon surviving filtration through a glass-fiber filter with a nominal pore size of 0.45 μ m. As a measure, the dissolved fraction defined in this manner tends to overestimate the actual dissolved organic carbon due to the variable occurrence of particles capable of passing through this filter.

In this system as in many surface waters in this country, the largest fraction of TOC in the water is the DOC fraction. In most cases, the errors present in the analysis makes them indistinguishable. Interpretation of results is made more difficult by the fact that modern analytical methods require very small samples for analysis. A few or even one unusual particle in a sample can provide a precise value for the sample but an inaccurate TOC estimate. Therefore, it is normal to encounter samples for which DOC appears to be similar to nearby waters while TOC has a much greater value.

For Blue River Lake in April (Figure 31) there were no trends for either form of organic carbon and the approximately equal numbers indicate that most of the organic carbon was in dissolved form. Concentrations occurred at approximately 1-2 mg/l. In May, TOC in Blue River Lake had a maximum concentration at 50 m depth that did not agree with the corresponding DOC. TOC and DOC at other depths were similar to each other as well as to the values observed in April. The maximum value observed at 50 m for May is possibly due to a sample artifact as explained in the previous paragraph. Organic carbon in Blue River Lake for July and August were again unremarkable and ranged from approximately 1-2 mg/l for TOC and DOC. At 10 m depth in July there was a small but real increase in both TOC and DOC. This depth was near the thermocline for the lake at that time and may have been associated with accumulation of settled materials which could contribute to both fractions of organic carbon. This was a very small difference compared to those observed September. Although DOC concentrations were approximately 1 mg/l at all depths, the September survey showed a large difference between DOC and TOC at the bottom depths of 40 and 50 m (Figure 31). Although the DOC remained at concentrations similar to other depths, TOC increased to 9-12 mg/l at those depths. Because of the magnitude of the value and the fact that the discrepancy was observed at two adjacent depths, these values are probably correct. As noted in the discussion of dissolved oxygen trends, an oxygen deficit was observed upstream of the dam in August. By September the biogeochemical activity which produced that deficit could have contributed suspended organic particles to the water which was moved to the dam as a result of the deep-water release. The analysis was not capable of identifying the nature of this material other than its organic content.

Cougar Lake had minimum organic carbon concentrations that were less than those observed for Blue River Lake. However, there were unusual trends for some times. The April lake values were remarkably uniform with a modest trend of increase with depth (Figure 32). Both TOC and DOC were similar in magnitude and trend suggesting that most of the organic carbon in this lake was in the dissolved fraction. In May, however, there were substantial differences between TOC and DOC at some depths and substantial heterogeneity through all depths. The surface concentrations were elevated with DOC (approx. 2.1 mg/l) occurring at approximately 35% of the TOC. However, to 20 m depth both fractions decreased to concentrations similar to the April samples. At 30 m both increased to concentrations similar to the surface. Another decrease to April values was observed at 40-50 m and at 60m another increase in both TOC and DOC was observed. This was followed by another decline at 70 and 80 m and a final increase at 90 m. The deepest sample, in contrast, declined to a values similar to those observed in April at approximately 1.5 mg/l. This heterogeneity is unexplained by other observations of chemical or biological materials and it poses a question that, without further inquiry, must remain unresolved.

The heterogeneity observed in the May samples for Cougar Lake apparently did not persist because the July and August surveys found no such trends except for the deepest waters. In July, the samples were uniform at approximately 1-1.5 mg/l to 80 m depth. At that depth the DOC exceeded TOC. In addition, TOC at 80 m remained similar to concentrations found at other depths. These facts tend to place suspicion on the measurement of DOC at 80 m as a potentially inaccurate estimate. Similarly, the result at 100 m of measuring 0 DOC is also unlikely and the trend in the deepest waters for DOC in July in doubt. However, if TOC is an indicator, the organic carbon was nearly uniform at all depths for July.

In August, the concentrations of organic carbon at all depths decreased to approximately 33% of their July concentrations. However, there was another anomalous observation of more than 8 mg/l TOC at 90 m depth which then returned to a value of approximately 1.5 mg/l at 100 m. DOC remained at nearly 0.5 mg/l at all depths. In September (Figure 32, cont'd) organic carbon distributions in Cougar Lake showed little trend except a slight increase at depths greater than 30 m. Concentrations at shallower depths were approximately 0.5 mg/l and at depths greater than 30 m concentrations increased to approximately 1 mg/l.

Stream concentrations (Figures 33-35) showed some trends. In April the water at most stations contained 1-1.5 mg/l TOC and DOC. Station MR-UP was the only exception with less than 1 mg/l TOC and DOC. In May a pattern of lower concentrations for inflows and greater concentrations for outflows and the downstream stations developed (Figure 33). The lowest concentrations were observed at stations SF-IN and MR-UP. The inflow stations LC, and BR-IN had concentrations similar to MR-GS and MR-HB the two stations farthest downstream on the McKenzie River (Figure 33). The outflows from Cougar and Blue River Lakes had the greatest organic carbon concentrations at approximately 1.5 mg/l. The intermediate stations MR-FR and MR-LD had intermediate concentrations of approximately 1.0 mg/l. By July the pattern became less clear (Figure 34). The greatest concentrations of TOC occurred at MR-GS and MR-HB (5-8 mg/l) while DOC (approximately 1.75 mg/l) was less than most of the other stations. The greatest DOC concentrations actually occurred at the inflow stations BR-IN and SF-IN (2.5-3.5 mg/l). The lake outflows and other stations were intermediate at approximately 2 mg/l TOC and DOC except for station LC which had the lowest concentrations of approximately 1.5 mg/l TOC and DOC. This mixed result continued in August (Figure 34) where all samples were low in concentration (indeed, undetectable for SF-IN and MR-UP) except for the downstream most stations MR-GS and MR-HB which had low DOC but elevated TOC concentrations at approximately 2-3 mg/l. In September, the pattern only had one anomaly, the TOC in the outflow from Cougar Lake (Figure 35). This anomaly was an elevated TOC concentration of approximately 3 mg/l at SF-OUT with a low DOC concentration of approximately 0.5 mg/l, similar to other stations. The anomalous greater TOC concentrations observed at occasional stations throughout this study may be explained by unexpected collection and analysis of particulates that are otherwise patchy in distribution or by unexplainable analytical problems. The low DOC concentrations accompanying these observations, however, indicate that aside from filtration and sampling considerations, organic carbon is remarkably uniform in this system.

Other Chemical Trends

Alkalinity

Of the chemical analyses performed, the one completed in the field was alkalinity due to the labile nature of dissolved gases likely to influence this measure. Alkalinities varied from approximately 9 to 25 mEq. The greatest alkalinities were always measured in water from the major inflow to Cougar Lake (SF-IN) and in the McKenzie River upstream from the project confluences (MR-UP). There was no obvious trend for alkalinity elsewhere.

Nutrients - Lake Survey Results

Nutrient concentrations (N and P) were often near detection limits for the analytical methods. In these methods the concentrations reported are units of elemental concentration. This means, for example, that nitrate concentrations are expressed as the mg/l of nitrogen contained in the nitrate and not the mg/l of nitrate. Concentrations of any form of N or P were usually low but were often expressed in this report units of mg/l. Total digestions often yielded concentrations up to several hundred ppb while undigested reactive nutrients usually were less than 50 ppb except in the deepest waters in the lakes. As often observed in other lakes, surface waters tended to have the least concentrations.

Phosphorus (P) was measured in three forms, two of which were products of digestions. In April P occurred in concentrations less than 40 ppb at all depths (Figures 36 and 37). Soluble reactive phosphorus (SRP), the form often referred to as ortho-P, occurred in lower concentrations than were observed for total P (TP) and total soluble P (TSP). SRP is the form of phosphorus that is immediately available for biological uptake. TP includes a solid fraction which is either organismal in nature or is another solid form which may not be immediately available for uptake. TSP has a soluble fraction that does not react colorimetrically until after digestion. TSP, then, includes SRP as well as other dissolved forms of P. Throughout the lakes in April, however, the concentrations were so low that the small observed differences may not be significant.

Nitrogen (N) was analyzed in four fractions. Total N (TN) includes all fractions containing N. Total soluble N contains all fractions that are not particulate. Ammonia (NH_3) is a reactive and potentially toxic form of nitrogen that is produced as a waste product of biological activity and is also readily utilized by plants as a nutrient. NH_3 occurs as a dissolved gas in water and forms the ion ammonium under many aquatic conditions. It is obviously not conservative and is capable of being quickly volatilized, oxidized, or incorporated into organic material. Nitrate (NO_3) is an oxidized form of N and is also readily utilized by plants. NO_3 exists only in ionic form and does not have a gaseous phase except by conversion to NH_3 . April TN and TSN for Blue River and Cougar Lakes (Figure 36) occurred at a concentration of approximately 0.1 mg/l. Because of the variation associated with the digestion, trends were not easily identified for this month. NO_3 occurred at lower concentrations (Figure 37) than observed for SRP. NH_3 was unmeasurable. These low concentrations were at or below detection limits and the fact that biologically available forms of N occurred at such low concentrations is indicative of N-limitation of plant growth.

May results (Figures 38 and 39) were similar to April except that there was a trend of increase for SRP with depth in Cougar Lake (Figure 39). In July trends of increasing concentration for TP, TSP, NO_3 , and SRP were observed in Blue River Lake (Figure 40). NH_3 could not be measured in Blue River Lake. Cougar Lake had concentrations of TP, TSP, and SRP that increased with depth (Figure 40). However, NH_3 and NO_3 showed large changes with depth with NH_3 peak concentrations at 30 m and NO_3 peak concentrations at 60 m and 110 m depth. Although NH_3 and NO_3 occurred at only 0.04 mg/l, TN and TSN occurred at greater concentrations of approximately 0.4 mg/l for Blue River Lake and 0.2 mg/l for Cougar Lake (Figure 41). There was no depth trend for TN or TSN in July.

In August P concentrations showed a trend of increasing concentration with depth for both lakes (Figure 42) but they occurred at low concentrations of approximately 0.01 mg/l in Blue River Lake and approximately 0.02 mg/l in Cougar Lake.

Except at the deepest depth, TN and TSN diminished to approximately 0.2 mg/l in Blue River Lake (Figure 43) compared to July. TN and TSN were unchanged in Cougar Lake. NO_3 had strong trends of increase with depth in both lakes in August (Figure 44) and occurred at maximum concentrations of approximately 0.06 mg/l at the bottom of Blue River Lake and 0.075 mg/l at the bottom of Cougar Lake. NH_3 was measurable in Blue River Lake but occurred at approximately 0.01 mg/l. NH_3 occurred at similar concentrations in Cougar Lake but with a peak concentration near the thermocline at 30 m depth (Figure 44). The peak concentration was approximately 0.06 mg/l.

In September TP, TSP, and SRP showed little trend in Blue River Lake (Figure 45). However both NH_3 and NO_3 increased with depth in that lake (Figure 45). TP, TSP, and SRP behaved very similarly in Cougar Lake with a small peak at approximately 30 m depth. TP also showed an increase near the lake bottom. TN and TSN seemed to decrease in Blue River Lake with depth in September whereas

they tended to increase with depth in Cougar Lake (Figure 46). The September trends for TN and TSN were weak and concentrations of these two N fractions occurred at approximately 0.2 mg/l for both lakes.

Stream stations showed interesting trends for nutrients. April results (Figure 47) show that concentrations of TN and TSN were similar for inflows and outflows for both lakes. There may have been slightly more TN and TSN entering Cougar Lake from SF-IN than was exiting at SF-OUT and slightly more TN and TSN just downstream from the confluence of the project outflows at MR-FR compared with MR-UP. Concentrations of TN and TSN seemed to occur at approximately 0.2 mg/l at most locations.

Interestingly, NH₃ always exceeded NO₃ in the stream samples for April. The greatest concentration of NH₃ occurred at BR-IN at approximately 0.035 mg/l. SF-IN also had approximately 0.03 mg/l and although the outflows had less than the inflows, MR-FR had more than 0.03 mg/l NH₃ compared with less than 0.01 mg/l at MR-UP. NH₃ at MR-FR exceeded the concentrations observed at the outflows. Although they were less than their respective inflows the reservoir outflows undoubtedly influenced this increase in the McKenzie River but the entire increase could not be explained by the outflows. Maximum NO₃ concentrations were observed in April at SF-OUT at approximately 0.015 mg/l. Other stations were nearer 0.01 mg/l except for BR-IN and MR-UP at which concentrations were approximately 0.005 mg/l.

April P fractions showed clear trends with the greatest concentrations of all fractions occurring at stations on the McKenzie River and the lowest concentrations at project inflows and outflows (Figure 47). There was a slight decrease in concentration of all P fractions downstream from MR-FR. These trends were similar in May (Figure 48) although the maximum concentrations decreased slightly to approximately 0.03 mg/l at MR-UP. There seemed to be a clear decline of SRP from a concentration of 0.03 mg/l at MR-UP to less than 0.01 at MR-HB.

In contrast, TN and TSN increased dramatically at MR-HB over all other sampling sites in May 1996 (Figure 48). At most locations concentrations of TN and TSN occurred at approximately 0.25 mg/l with the lowest ones occurring at McKenzie River stations MR-UP, MR-FR, and MR-LD. At MR-GS TN increased to approximately 0.35 mg/l although TSN remained at less than 0.25 mg/l. At Hayden Bridge, these increased to greater than 0.5 mg/l TN and almost as much TSN (Figure 48).

In May NH₃ was undetected at all stream stations. NO₃, however, was detected at low concentrations of approximately 0.005 mg/l or less at most stations (Figure 48). However, again there was a trend of increase with distance downstream on the McKenzie River with the greatest NO₃ concentration at Hayden Bridge of approximately 0.016 mg/l.

In July, P concentrations mostly followed the pattern observed in April and May (Figure 49). However, SF-IN showed elevated concentration over other inflows and outflows. And SF-OUT contained greater than 0.05 mg/l TSP while other fractions of P were 50% of inflow concentrations (Figure 49). MR-UP was again generally higher in concentration for all fractions of P compared with other stream stations. These occurred at approximately 0.05 mg/l and tended to decrease with distance downstream to approximately 0.035 mg/l.

TN and TSN concentrations showed little trend except for SF-OUT which had greater than 0.5 mg/l TSN which greatly exceeded TN (Figure 49). This fact makes the measurement suspect because TN should always be approximately equal to- or greater than TSN. A large difference in the opposite direction may be due to a contaminant or an analytical error which in this sample could not be discovered.

NH₃ was undetected at locations along the McKenzie River and the sample for MR-FR was lost in transport. Where NH₃ was detected, the maximum value occurred in the outflows of both lakes (Figure 49). BR-OUT had a concentration of NH₃ of approximately 0.023 mg/l while SF-OUT had 0.015 mg/l. NO₃ occurred at approximately 0.005 mg/l where detected except for SF-IN and SF-OUT. The Cougar Lake inflow, SF-IN contained approximately 0.01 mg/l NO₃ and SF-OUT contained 0.015 mg/l NO₃. NO₃ was undetected at BR-OUT.

In August, NH₃ and NO₃ were detected at all stream stations (Figure 50). Concentrations, moreover, were approximately 0.005 to 0.010 mg/l at all locations for both NH₃ and NO₃ except for the outflows BR-OUT and SF-OUT which had NO₃ concentrations of approximately 0.05 mg/l. TN and TSN were also similar for most stations except for BR-OUT which had almost 0.5 mg/l TN and MR-GS and MR-HB which had approximately 0.35 and 0.25 mg/l TN respectively. The elevated TN concentrations at MR-GS and MR-HB occurred after a decline along the other locations of the McKenzie River to a concentration of approximately 0.11 mg/l at MR-LD (Figure 50). Also at MR-LD there was an anomalous elevated concentration of TSP as had been observed for July at SF-OUT.

Stream P concentrations for August followed a remarkably similar pattern to that observed in July with the exception of low TSP for SF-OUT in August compared to the anomalous high concentration observed in July (Figure 50). The greatest concentrations for all fractions of P were observed at MR-UP. These declined downstream to MR-HB. Inflows to the reservoirs tended to contain greater concentrations of P fractions compared with the outflows. This was especially true for SF-IN which contained more than double the concentration of SF-OUT.

In September the pattern was again similar to that observed in August (Figure 51). Concentrations of P were maximum at MR-UP and declined with distance downstream. Inflows to Blue River Lake and BR-OUT contained the lowest concentrations. SF-IN was again much greater than SF-OUT with regard to all P fractions.

TN and TSN showed virtually no pattern (Figure 51) and NH₃ was undetected at all locations. NO₃, however showed elevated concentrations of approximately 0.023 mg/l at BR-OUT and 0.014 mg/l at SF-OUT. MR-UP contained no detectable NO₃ and the concentrations of NO₃ observed downstream (approximately 0.005 mg/l, near the limit of detection) may be due to releases from the reservoirs at that time.

Other chemical components

An additional trend that was observed was the difference between the tributary systems with regard to sulfate (SO₄). Blue River, the McKenzie River, and Blue River Lake occasionally contained concentrations of this ion in the part per million (ppm) range. These concentrations were as much as four times greater than those observed for Lookout Creek, the South Fork McKenzie River, and Cougar Lake. The greatest concentrations of SO₄ were observed in Blue River (BR-IN) in September with nearly 5 ppm.

Additional analytical capability was incorporated in July with the additional ability to measure potassium (K), magnesium (Mg), and calcium (Ca). For the remainder of the season the stream samples from Blue River and the McKenzie River contained the greatest concentrations of these cations, approximately 4 ppm for K and Ca and approximately 2 ppm for Mg. There were no patterns except that the lakes contained lower concentrations.

The metals, iron (Fe) and manganese (Mn) were assessed because they are common in certain aqueous environments. They occasionally existed at measureable concentrations in this system but showed no important trends. The numerical data for SO₄, K, Mg, Ca, Fe, and Mn are in Appendix B, Chemistry Data.

Biological Analyses - Chlorophyll

Of the biological measurements, chlorophyll biomass is the most repeatable assessment. Chlorophyll *a* showed strong trends in both lakes and no trends whatsoever in the stream samples. At all inflow, outflow, and river stations, chlorophyll *a* was always less than 1 µg/l. The absence of chlorophyll from these sites was not unexpected.

Blue River Lake had a strong chlorophyll *a* peak at 10 m depth in May 1996 (Figure 52). The peak concentration was nearly 10 µg/l and was coincidental with an algal bloom ongoing in that lake. At all other depths and times concentrations were less than 2 µg/l.

Cougar Lake had a more visible algal bloom than Blue River Lake and this was shown in the chlorophyll *a* data (Figure 53). A peak concentration of approximately 15 µg/l occurred at the lake surface in May followed by a July peak of approximately 6 µg/l at 10 m depth. At all other times chlorophyll *a* concentrations were less than 2 µg/l. The Oregon standard for chlorophyll *a* concentrations is 15 µg/l, the maximum observed for Cougar Lake. At no time was a greater concentration observed elsewhere in the system.

Chlorophyll fluorescence measured in situ did not exhibit a strong fluorescence peak and where it did, followed the same trend as seen in the results of chlorophyll *a* analyses.

Phytoplankton

Samples were taken at 10 m depth intervals at station 1 of both lakes. Enumerations were completed for most of these samples although so few cells were encountered at depths greater than 30 m that only brief 'scans' were completed for deeper depths to confirm the low population densities. Phytoplankton densities in Blue River and Cougar Lakes are reflective of the chlorophyll concentrations described earlier. The phytoplankton of these lakes are typical of many such lakes and are dominated by cyanobacteria for much of the spring and summer.

In Blue River and Cougar Lakes, the dominant taxon was *Anabaena circinalis*. This taxon was identified on the basis of the growth form which placed it in the genus *Anabaena*. The specific identity was determined by the filament characteristics, and the dimensions and shape of vegetative cells, heterocysts, and akinetes. Figure 54 summarizes the distribution of this alga in Blue River and Cougar Lakes. Its presence in waters deeper than the thermocline was noticed but cells appeared to be in a state of decomposition, to be expected at those depths. The absence of active chlorophyll *a* at those depths supports the hypothesis that cells sinking to those depths are either not active or decomposing.

Other taxa noted included diatoms, green algae, and dinoflagellates (specifically *Ceratium*). Where there were significant phytoplankton densities present, based on numerical counts, the dominant taxon was always *Anabaena*. The presence of other taxa was expected but those taxa did not form populations of importance comparable to *Anabaena circinalis*.

An important feature of the population of *Anabaena circinalis* was the presence of a large percentage of heterocysts, cells that function to incorporate free gaseous nitrogen into an organic form (nitrogen fixation). In these lakes heterocysts represented from 5% to 9% of the population cell density.

Another noticeable feature is the presence of akinetes in mid- to late-summer. Akinetes are specialized cells which are capable of resisting conditions not conducive to growth. They are sometimes referred to as 'resting stages' and may function as the source of subsequent populations in successive seasons of growth. Akinetes were found in all samples but incidental samples taken in surface scums were almost exclusively composed of akinetes making taxonomic identification difficult initially.

Anecdotal observations can be useful but are rarely of any quantifiable importance. However, during August when station 1 at Cougar Lake had low phytoplankton densities, a thick cyanobacteria scum was present elsewhere in the lake. This accumulation had formed in July and was observed in several locations during sampling. The location seemed dependent on the direction of prevailing winds.

Anecdotal observations made during stream sampling also indicated the presence of a heterogeneous algal growth. These growths were composed primarily of green algae and diatoms and occurred in May in the downstream reaches of the McKenzie River, in August and September in the inflow streams, and continuously in the outflows from the two dams. The tailrace below Blue River Dam had particularly massive growths of filamentous algae that occasionally obscured the rock substrate.

SELECT Analysis of Cougar Lake Outflows

The numerical method SELECT (USACEWES rev.1992) was employed to analyze the relationship between outflows from Cougar Dam and the water column characteristics in Cougar Lake. SELECT is a computational tool which uses information about intake design, flow rate, lake elevation, and water column characteristics to predict the characteristics of outflows. Because appropriate information was known and collected for Cougar Lake this approach was employed to explore those relationships.

SELECT is a one-dimensional numerical model that predicts the vertical extent and distribution of withdrawal from a reservoir of known density and quality distribution for a given discharge from a specific outlet. It is simple approach in which simplifying assumptions are made regarding such factors as water density or lake dynamics. These assumptions are often violated but if the approach is used to make instantaneous predictions and the characteristics being investigated do behave in an approximately conservative manner, it can successfully predict outflow characteristics.

Cougar Lake presented some strong violations of these assumptions. The most important of these were related to the morphometric characteristics of the lake near the intake. Specifically, a deep area at the intake associated with Rush Creek is isolated from the main body of the lake by a submerged hill or ridge which extends from the south shore under the lake to the dam. This obstructs water movements downstream at depths greater than the ridgetop. Furthermore this obstruction occurs a significant distance upstream from the deep intake. At low flows common for much of the summer, this distance corresponds to an undetermined but large amount of travel time. Therefore, characteristics in the main body of the lake have some time to change during travel from the point of measurement to the intake structure.

Significant time of travel weakens the assumption that a characteristic of interest is conservative. SELECT assumes that travel time is short enough that temperatures, dissolved oxygen, or other chemical concentrations do not have time to change significantly allowing an accurate prediction. SELECT also

does not account for the dynamic changes associated with depletion of water from certain depths and replacement with different characteristics. In Cougar Lake both limitations are present. In the first instance, travel time is probably long enough that some parameters can change before reaching the intake. In the second instance, measurements taken in the main body may not accurately depict the conditions of water then reaching the intake. These are obviously related problems.

SELECT also has two primary modes, selective withdrawal through one or more intake ports and withdrawal with a submerged weir upstream from the intake. Cougar Lake does not technically fit either of these modes. However, this study was able to achieve prediction success employing a weak assumption that the submerged ridge at Rush Creek is a submerged weir. This success actually reveals some important characteristics of Cougar Lake and the results of the SELECT runs were used for later interpretation of the results in the conclusions of this report.

Initial trials using the actual port specifications for the Cougar Dam intake failed to accurately predict the observed outflow temperatures or dissolved oxygen concentrations. All efforts to impose accurate characteristics for the intake structure failed. The differences between prediction and observed values were too great to be accounted for by the non-conservative nature of the parameters. Another way to view this is that the travel time between the intake port and the outflow structure was too short to account for significant changes in temperature or dissolved oxygen. Therefore, other factors between the intake structure and the rest of the lake must have altered the water characteristics near the intake structure.

The only plausible explanation for such an external factor was that deeper water movements were restricted by the submerged ridge associated with Rush Creek. When the intake was specified as a submerged weir with characteristics based on the approximate shape of the submerged ridge, acceptably accurate predictions were made. For those successful SELECT trials the characteristics of the submerged weir were specified as listed in Appendix F which presents the actual output of those trials. Briefly, the weir was described as being 100 ft in length with a crest elevation of 155 ft above the greatest depth in the lake.

SELECT trials were completed for all sampling months except for April during which time the lakes were most weakly stratified and were still filling to maximum summer elevations. Because the water quality concerns were mostly associated with the later summer season, trials were confined to that the period of May to September. From May to September outflows from Cougar Lake were minimal, approximately 14 - 31 cfs. It was found from repeated trials that at those modest flows, that the length of the weir crest was unimportant unless narrowed to approximately 10 ft. At that extreme the velocity field was altered such that deeper waters were predicted to be entrained making less accurate predictions. Doubling the weir length to 200 ft had no significant effect.

The altitude of the crest above the lake bottom was more critical. Examination of the topographic information from maps and construction specifications indicated that the ridge crest just upstream from the inflow of Rush Creek is irregular and highly variable. The elevation at its deepest location was approximately 105 ft but most of the ridge had a greater altitude above the lake bottom. There was no means to actually measure the depth of this ridge with accuracy. Therefore in order to employ the numerical approach for predictions of other water quality characteristics, the altitude of the ridge was adjusted during trials for temperature and dissolved oxygen until reasonably accurate predictions were attained. As indicated in the appendix, the least altitude that gave acceptable results was 155 ft.

During SELECT trials the specification of a submerged weir disallows any additional specification of intake port characteristics. Therefore, for these trials, the adjustment of the altitude of the

weir crest accounted not only for travel time effects, but for other intake characteristics, and any non-conservative tendencies as well.

Table 8 shows the comparison of temperature and dissolved oxygen for predicted and measured values. As listed in the table, dissolved oxygen was more accurately predicted than temperature. This should not be interpreted too liberally. Comparison of the dissolved oxygen data to the temperature data in the lake showed greater changes with depth for temperature than dissolved oxygen. This could explain the difference in accuracy. Another explanation could be that the water changed temperature slightly during the travel time but not dissolved oxygen. Either or both explanations could be true. Nevertheless, the agreement for both parameters was acceptable and the intake characteristics for those trials were subsequently employed with the organic carbon data collected from chemical analysis of the lake and the outflow.

The SELECT trials for temperature and dissolved oxygen were reasonably good. One exception was for 25 September 1996 at which time outflows were measured at 12.5°C while SELECT predicted 10.15°C. At other times the difference was smaller, usually increments of 0.2 C° or less and within the known error for the measuring device. Dissolved oxygen was predicted by SELECT to be within approximately 0.5 mg/l or less of the measured value. The fact that dissolved oxygen usually increased in the measured value could be the result of aeration between the outlet structure and the location of measurement a short distance downstream.

The results of the SELECT trials incorporating TOC and DOC are instructive (Table 8). Whereas the TOC and DOC measurements were subject to occasional anomalous concentrations, SELECT was acceptably realistic in its predictions. Most organic carbon in the lakes was in the dissolved form (DOC) and SELECT was within 1 mg/l of measured values for DOC. The largest difference occurred in July when there was a time difference of approximately two weeks between data taken for the lake and data taken for the stream stations. Often SELECT was within 0.2 mg/l of the measured value, good agreement for a parameter difficult to measure accurately. The success with DOC, then, sheds light on results for TOC which present greater analytical challenges. TOC includes particulate carbon and should always be equal to or greater than DOC. In the McKenzie River system, occasional large concentrations of TOC were encountered. These were occasionally larger than expected and the analytical error may explain these occurrences. One such occurrence existed for the Cougar Dam outflow on 25 September 1996. At that time a concentration of TOC approximately 3.12 mg/l was measured. This was nearly an order of magnitude greater than measured for DOC (0.46 mg/l) and unexpected. SELECT used the data for the Cougar Lake water column to predict that TOC should have been approximately 0.66 mg/l. This prediction was consistent with the expected TOC concentration in that TOC should have been slightly greater than DOC which was predicted and measured at 0.57 and 0.46 mg/l respectively. This supports the possibility that the TOC value measured at 3.12 mg/l is incorrect and adds robustness to the measured data from Cougar Dam.

SUMMARY AND CONCLUSIONS

The proposed structural modification to Blue River and Cougar Dam intake structures (U.S. Army Corps of Engineers 1994a) will alter the thermal characteristics of the lakes, the outflows, and the McKenzie River in a manner which is favorable to fisheries interests. However, other resource users expressed concern regarding other potential impacts to the river and to the quality of the water supply. These concerns were primarily with regard to turbidity, organic carbon, taste and odor, and nutrient concentrations. This study was performed to assess the current status of this system as well as the potential impact with regard to the above concerns. Because the U.S. Army Corps of Engineers Portland District had previously performed a survey regarding taste and odor with negative results (James Britton personal communication) and because the analytical capability necessary to address this concern was not available for this study, taste and odor was not addressed. However, the study did address the other concerns and these conclusions summarize the current status of this system and the possible effect of the proposed modifications on this system.

The thermal trends in the two lakes are controlled by two major factors, hydrodynamics and meteorological forces. The resulting thermal structure affects dissolved oxygen distributions and to some extent, pH, ionic content, and organismal distributions. Current impacts on the thermal structure of Blue River and Cougar Lakes as well as the expected changes following proposed modifications were exhaustively described in a separate report (U.S. Army Corps Engineers 1994b)

Dissolved oxygen is one of the most important factors determining habitat for aquatic life. No observations were made that showed significant anoxia in either lake, although the tendency for oxygen decrease in the hypolimnion was observed. In Blue River Lake, anoxia was observed near the lake bottom at one location during late summer.

Turbidity was identified as a potential problem although the maximum values observed were not excessive. The state of Oregon allows no more than a 10% increase over a control immediately upstream from the source of turbidity (Oregon Department of Environmental Quality 1996). If Blue River Dam and the stored suspended material from earlier inflows is interpreted as a source of turbidity, and if the inflowing streams are used as the upstream controls, then this standard was violated during this survey. However, the maximum turbidity observed in the stream did not exceed the EPA guideline of 25 NTUs. The tendency for these lakes to retain turbid materials and to release them over time has been noted previously (U.S. Army Corps of Engineers 1994a) and this study confirmed that tendency.

Turbidity tended to increase with depth in both Blue River and Cougar Lakes, an expected outcome of settling suspended materials. Any modification that selectively released water from shallower depths would obviously decrease the turbidity in the outflows. In confirmation of this, although the turbidity of the lake waters was greater near the bottom for Cougar than for Blue River Lake, the mid-depth water release of Cougar Dam had less turbidity than releases from Blue River Dam.

In the proposed modification, releases will be made from depths which contain water temperatures that meet the target criteria. These shallower depths are likely to be less turbid leaving cooler more turbid waters at depth for later release during the fall drawdown noted in Figure 5. The tendency of these basins to act as traps for this material will be maximized under this scenario and the greatest impact on turbidity may occur later and with less intensity. It is important to note that although the turbid materials seem to be the result of sudden or large inflows, biological processes can also modify these and the actual outcome may depend on additional processes.

The distribution of organic material in the system suggests that great concentrations of organic carbon are rare, at least in forms available for water analysis. Oregon did not list a state standard for organic carbon and the range of concentrations of organic carbon in surface waters is large and dependent on many factors. The large debris entering the system as a result of flooding may be a contributing factor to the organic carbon in the water but this study did not address the potential sources of organic material. TOC and DOC were observed in the 1 to 2 mg/l range at most locations and times. Occasional greater concentrations up to 12.56 mg/l were observed for TOC but sometimes in inexplicable locations.

Blue River Lake usually had approximately 1 to 2 mg/l TOC and DOC indicating that most of the organic carbon in this lake exists either dissolved or as particles small enough to avoid being removed by filtration. May and September TOC concentrations were exceptional and could not be explained against the comparison with earlier or later samples at the same depths. However, under current conditions these concentrations, if real, are confined to the greatest depths of the lake.

Under current conditions, the release of these materials downstream did not clearly affect the subsequent locations on the McKenzie River. Although the lowest concentrations of organic carbon were often observed upstream (MR-UP), the concentrations downstream were unrelated to the outflow concentrations from the projects. Indeed the greatest concentrations observed at stream stations were for the farthest stations downstream for TOC in July (8 mg/l) and for the inflows to the reservoirs for DOC (3.6 mg/l at BR-IN), also in July.

Under current conditions the lakes do contain greater concentrations of TOC and DOC than inflows at most times and may contribute to small increases to organic carbon in the McKenzie River. However, this trend is based on small differences and the distribution of organic carbon in the lake suggests that releases from shallower depths will not likely cause further increases in organic carbon in the outflows.

The proposed modification would likely retard the release of particulate organic materials potentially improving the quality of releases during the stratified season. Retention for a longer time raises additional questions regarding the fate of these materials especially where biological activity has already been observed producing hypoxic conditions at depth (Blue River Lake). These organic particles may be available for the production of additional DOC or they may be converted to inorganic carbon (CO₂ or bicarbonate) through respiration processes.

In studies more recent than this (Stepczuk 1997), additional issues regarding the contribution to organic carbon to the formation of unwanted disinfection by-products such as THM or similar compounds have been identified. These issues include the relative contribution by various forms of organic carbon, the major forms being dissolved versus total or particulate. The drinking water standard is for TOC although increasing evidence shows that the dissolved fraction actually contributes to the unwanted compounds. In addition, the nature of the DOM has come into question with aromatic organic forms being proposed as more contributory than aliphatic forms. These unresolved issues are important to the McKenzie River lakes and streams because the greatest DOC and TOC are contributed to the system from the watershed. And these organic compounds are more likely to occur as the aromatic forms. Organic carbon formed in the lakes autochthonously, however, tend to take the aliphatic form and if the contributory difference between them regarding THM precursors is true, then the newer techniques capable identifying the form should be included in future work. In this manner, the actual contribution of organic materials by the lakes can be identified and the relative contribution to THM precursors through the various forms of organic carbon can be described.

Oregon supports the EPA guideline of 0.1 mg/l for phosphorus in these and other waters (Oregon Department of Environmental Quality 1996). No mention was made for other nutrients which poses an interesting situation for waters that are nitrogen-limited such as the McKenzie River system. Moreover this guideline makes no distinction between the various forms that P can assume, some more available to biota than others. Regardless, P concentrations in any form never exceeded the guideline during the course of this study.

Nutrient concentrations in this system were also noteworthy because of their often low concentrations and because of the tendency of plankton to interact with the nutrients. Furthermore, concentrations of N and P were observed in ratios indicative of nitrogen limitation for these waters. Nutrient limitation in this sense is defined using an atomic ratio test in which the ratio of nitrogen to phosphorus (the N/P ratio) is examined. If greater than approximately 12 - 15, phosphorus is suspect as a potential limiting nutrient. If the ratio is less, nitrogen is suspect. Although growth potential assays and other laboratory tests may be performed to elucidate the finer qualities of these relationships, this study used the N/P ratio and the fact that dominant organisms were capable of fixing external sources of nitrogen as diagnostic of N-limitation.

The tendency of this system to be nitrogen limited was also previously noted in the EIS (U.S. Army Corps of Engineers 1994a). Much of each of the nutrient elements, N and P, was in some combined form, not ionic, and hence was more available where processes tended to decompose those combined materials into inorganic or ionic species.

Under current conditions, N is the limiting nutrient although it seems to occur in substantial concentrations at certain times and locations. This is especially true for TN and TSN in Blue River and Cougar Lakes. These forms of N can be made available for microbial uptake through decomposition processes which can produce NH_3 . In what is a rapid oxidation step NH_3 oxidation consumes oxygen in the waters where this process takes place. This is important where NH_3 production occurs and especially if oxygen is not replenished. The ultimate product of this oxidation is NO_3 . Both NO_3 and NH_3 are available as plant or microbial growth nutrients. Both of these tend to be distributed in greater concentrations at greater depths in both Blue River and Cougar Lakes.

Processes which consume oxygen require organic material in order to continue. The products of respiration processes include mineral substances which may contribute to dissolved ionic content of the water. Evidence of such processes was found in the observed decrease in oxygen over the season as well as the apparent increase of specific conductance at certain depths below the thermocline.

The relationship between oxygen dynamics, phytoplankton growth, and nitrogen metabolism (especially where N is a limiting nutrient) is complex but very important to determining water quality in many systems. This study did not assess the full implications of these complex interactions.

Differences in specific conductance throughout the system also reflected the varying nature of the geologic composition of the watershed as did distributions of sulfate. These distributions had little relationship to aquatic processes in the lakes. If anything, the lakes tended to dilute the ionic content of the McKenzie River, as measured by specific conductance.

Biological activity in these lakes is strongly influenced by the available nutrients present in the waters. The phytoplankton bloom as recorded by chlorophyll a concentrations showed a strong peak in May and a decline through July. The distribution of this bloom is near the surface although cells are found at greater depths later in the summer. Most autotrophic activity occurs in the surface 10 meters of the lakes and this corresponds approximately to the photic zone.

The dominant component of the phytoplankton is *Anabaena circinalis*, a cyanobacteria. It furthermore forms heterocysts and is capable of fixing nitrogen from dissolved gases in the water. Heterocysts are specialized cells formed by some genera of cyanobacteria and are the site of N-fixation for those cyanobacteria. *Anabaena circinalis*, then has a competitive advantage over other algal forms competing for nutrients, especially the limiting nutrient, nitrogen. At present, peak chlorophyll biomass values approach 15 µg/l during bloom conditions. This maximum biomass was observed at one depth and at one time although heterogeneities in the spatial distribution of these organisms could produce localized greater concentrations of biomass. Additional study would be required to completely answer questions regarding the growth and distribution of these blooms throughout the lakes.

Another capability of the genus *Anabaena* is the formation of gas vesicles. Gas vesicles are structures internal to the cells which, filled with gas, cause more or less buoyancy for the cells possessing them. Although this study did not examine the degree to which this occurred in Blue River and Cougar Lakes, qualitative tests supported the hypothesis that the cells did contain gas vesicles during bloom conditions. This test involved applying external pressure to floating accumulations of cells which, if they possess gas vesicles, will tend to sink after the pressure is applied. Such buoyant capability would tend to keep the bloom near the surface depths of the lake and may be responsible for the observed scums during July and August.

Nitrogen limitation, dominance by *Anabaena*, the relatively high percentage of heterocysts, and the ability to form resistant cells and gas vesicles make this organism well adapted to Blue River and Cougar Lakes. The populations will always have the capability of blooming and changes in the system could influence growth or distribution.

The tendency of NO₃ and NH₃ as well as other chemicals to increase concentrations in the deeper waters is important to the proposed operation of Blue River and Cougar Projects. Any modification that causes the deeper waters to remain 'isolated' for a longer time will tend to allow these chemicals to accumulate in greater concentrations. In other lakes such as Carter's Lake in Georgia or Yatesville Lake in Kentucky this has led to substantial accumulations of reduced metals such as Fe or Mn or soluble nutrients such as PO₄ or NH₃. In those lakes the process of mixing and aeration of the water during the winter has not been complete unlike Blue River and Cougar Lakes which do experience complete mixing each year. However, if NO₃ or NH₃ accumulate during the stratified season, these will become available to the photic zone (where light is available for plant growth) during mixing or else they will be released downstream during the drawdown phase of the rule curve (Figure 5).

The hydraulic retention time of these reservoirs varies greatly and depends on the season and lake level. In the summer when materials can accumulate in deeper waters or be released from the sediments, the hydraulic retention time is much greater than during the high flow season especially if the lakes' surface elevations are at their minima. The nutrient release peaks observed during September (Figure 51) could increase as a result of the proposed modifications.

The effect of such releases of nutrients is speculative but may contribute to increased algal growth in the downstream reaches if other conditions are favorable for such growth. If there is increased availability of these nutrients (NO₃, NH₃) to the surface waters of the lakes, increased algal growth will likely favor competitors of the cyanobacteria and some shift of late summer algal dominance may be observed.

Change of release depths to shallower warmer waters may also impact plankton populations through physical removal. During the summer waters released would tend to remove populations in the vicinity of the intake, in essence exporting biomass from the lakes. Depending on flow rates, growth

rates, and spatial distribution, the loss of biomass due to releases may cause the populations not to reach the peak densities currently observed. Or growth may be maintained over a greater time. There is still much that is not known nor can predictions be made that are accurate or precise with regard to these populations.

Recommendations for future work on these projects include the following:

1. basic monitoring studies in which the predicted thermal and limnological behavior of the projects is confirmed,
2. stream monitoring for physical and chemical characteristics using sites similar to those employed in this study,
3. population surveys to monitor the major taxa and population densities in the lakes,
4. quantitative surveys of aufwuchs growth in the McKenzie River to discern growth impacts,
5. additional study of the dynamics of nitrogen metabolism in Blue River and Cougar with the goal of refining and applying a modeling approach to prediction of ecosystem responses.

Recommendations 1 and 2 are similar to the scope of this study. The third recommendation is also similar although future study should place greater emphasis on population dynamics. The fourth recommendation will elucidate the real trends of algal growth in the streams - trends that have been incompletely described at this time. The last recommendation is complex and requires laboratory analysis of complex nutrient interactions. The benefit derived from recommendation 5 will be an ability to predict the consequences to the ecosystem as a result of the project modifications and an understanding of the mechanisms controlling that outcome.

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FIGURES

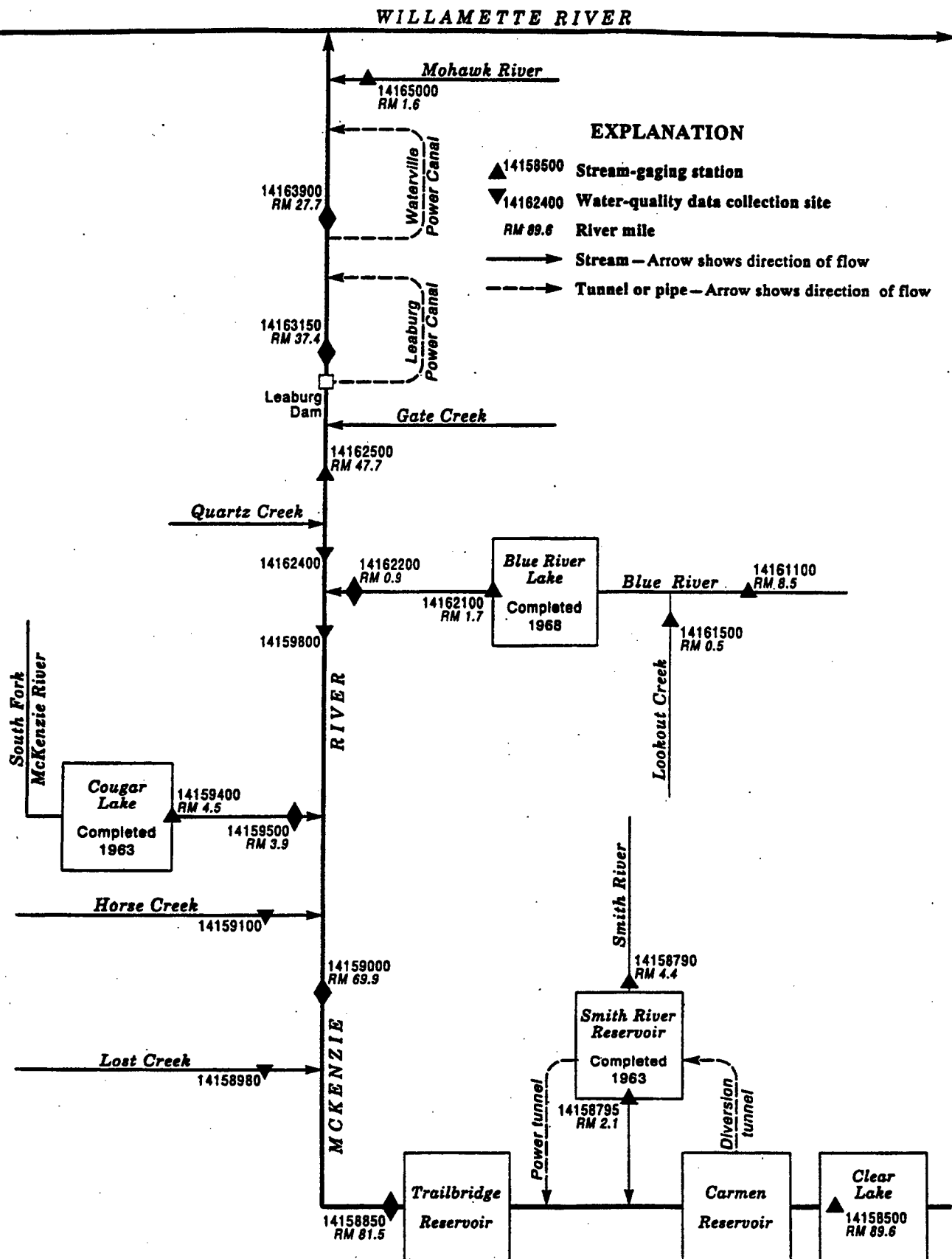


Figure 1. Schematic diagram of the McKenzie River Basin showing the complex of reservoirs, diversions, lakes, tributaries, and the USGS gaging stations located within the basin. Note: the station on the South Fork of the McKenzie River upstream of Cougar Lake is not shown in this diagram. (Source, U.S.G.S. Water Data Report OR-95-1)

Cougar Lake

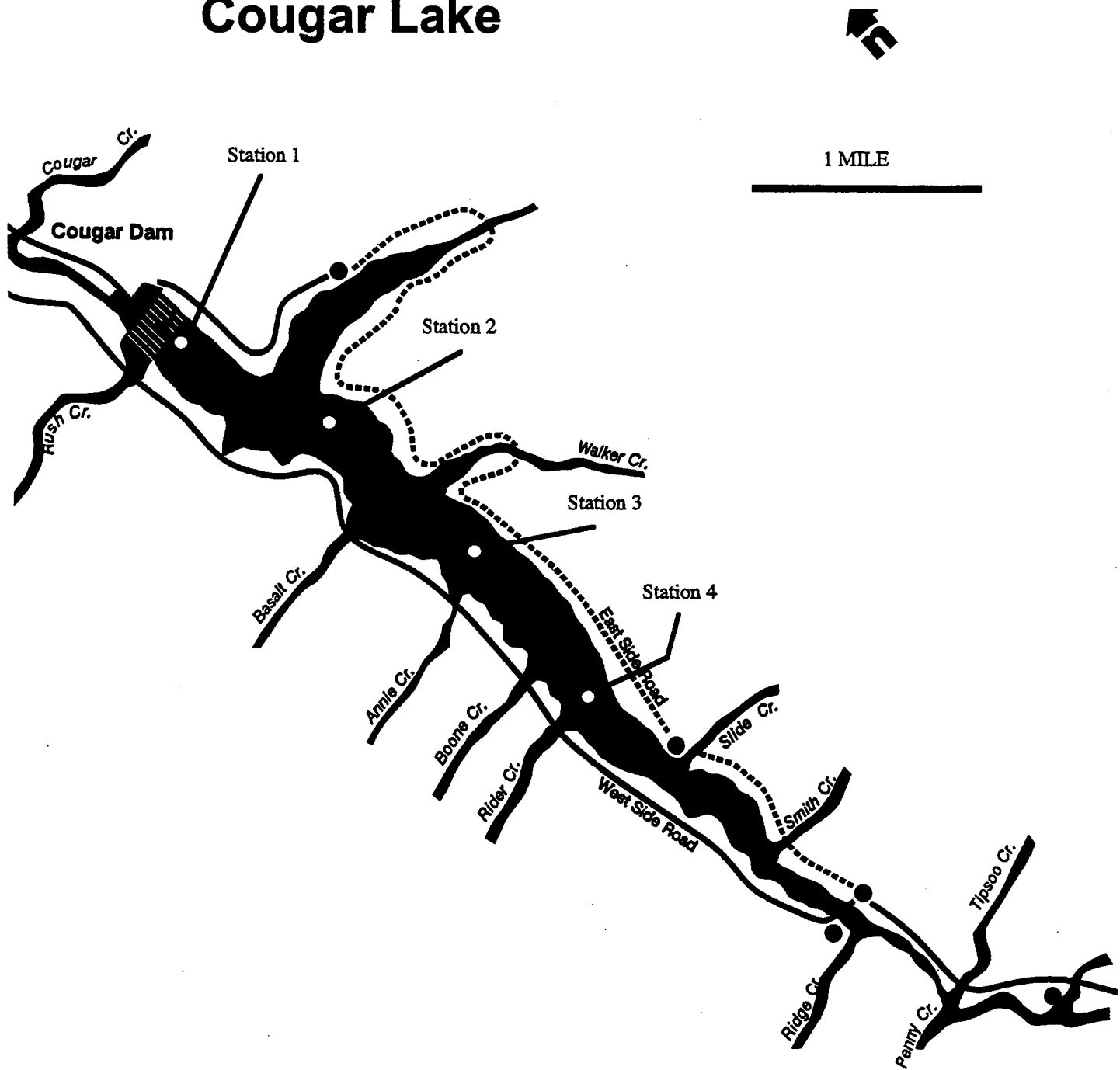


Figure 2. Map of Cougar Lake showing the locations of tributaries and sampling station locations

Blue River Lake

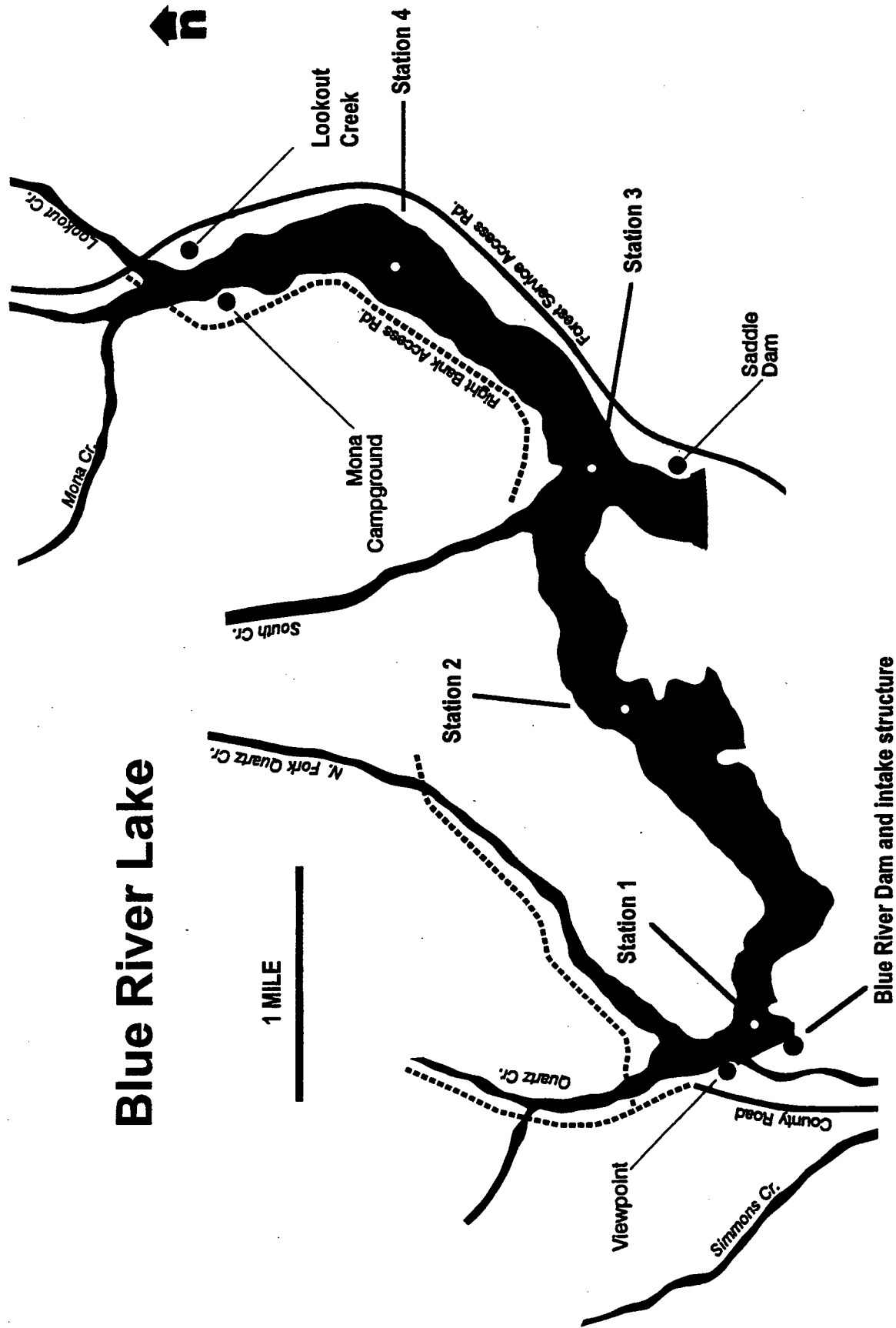


Figure 3. Map of Blue River Lake showing the locations of tributaries and sampling station locations

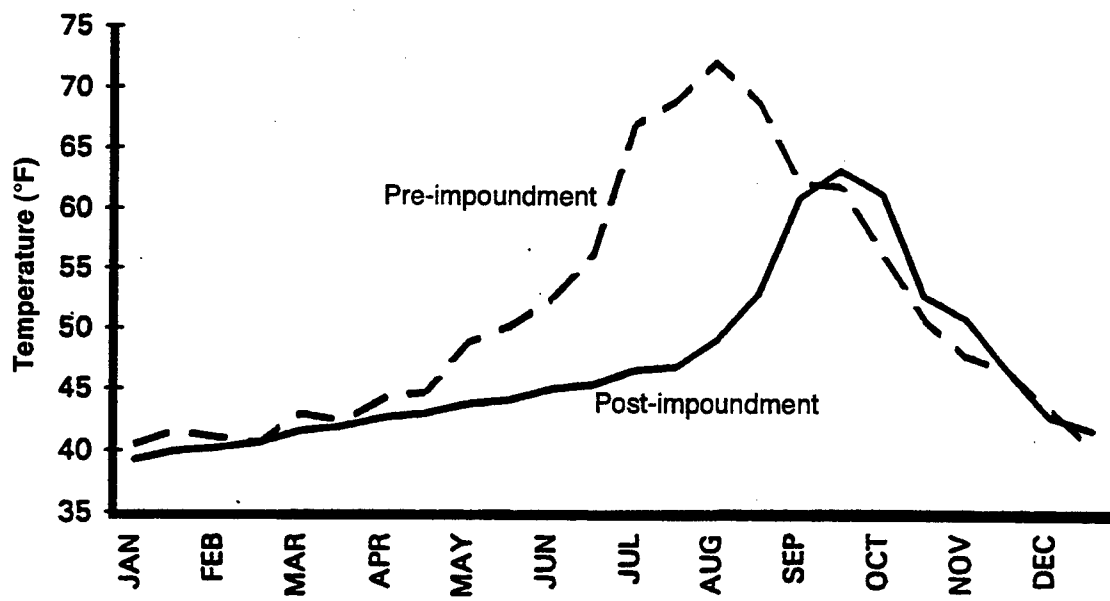


Figure 4. Plot of temperatures downstream from Blue River Dam prior to and after impoundment.
Note: Graph is base on USGS temperature data. (Reproduced from USACE 1994)

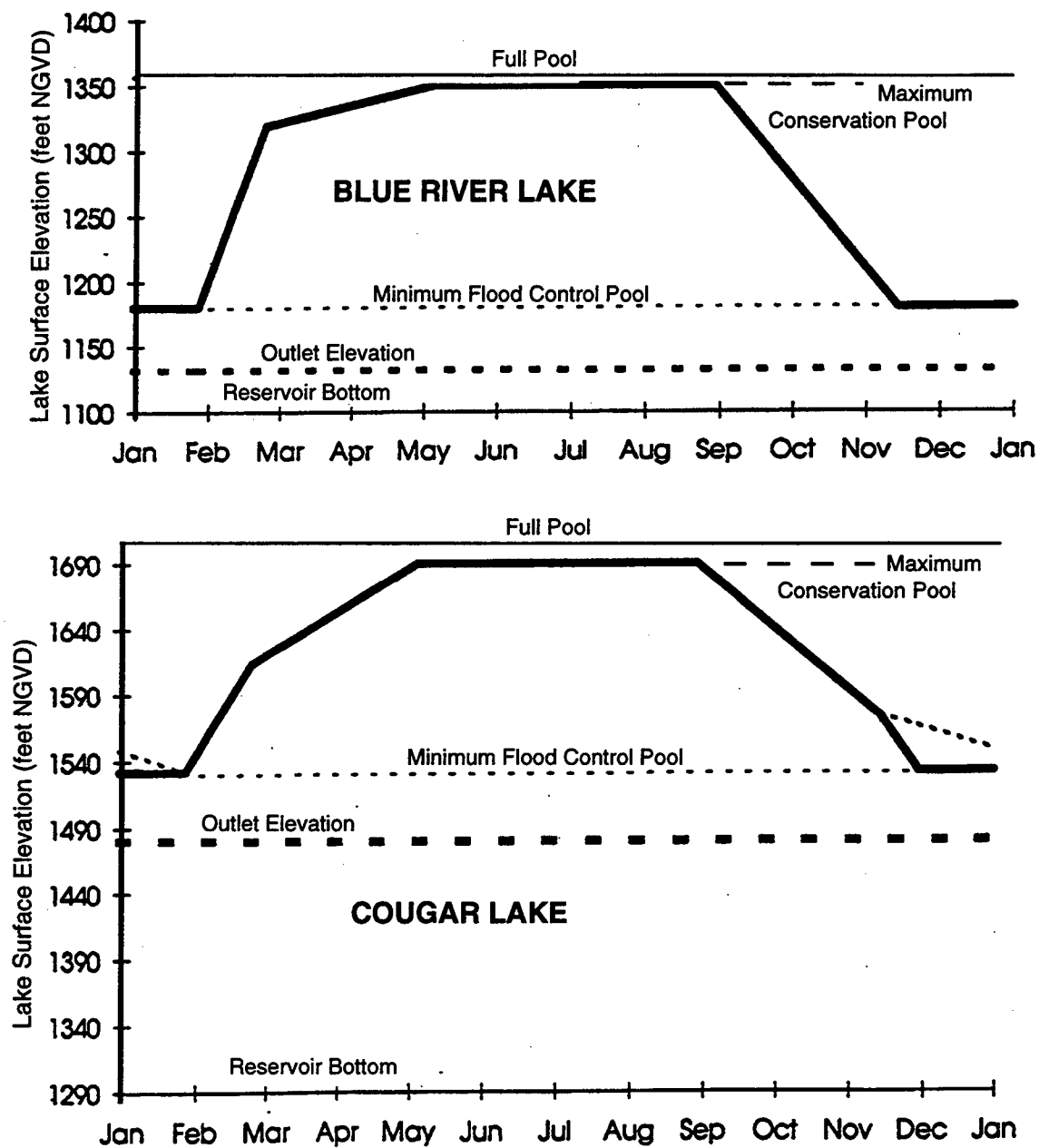


Figure 5. Diagrams of reservoir elevation schedules for Cougar and Blue River Lakes.
(Taken from the Feasibility Report, USACE 1994)

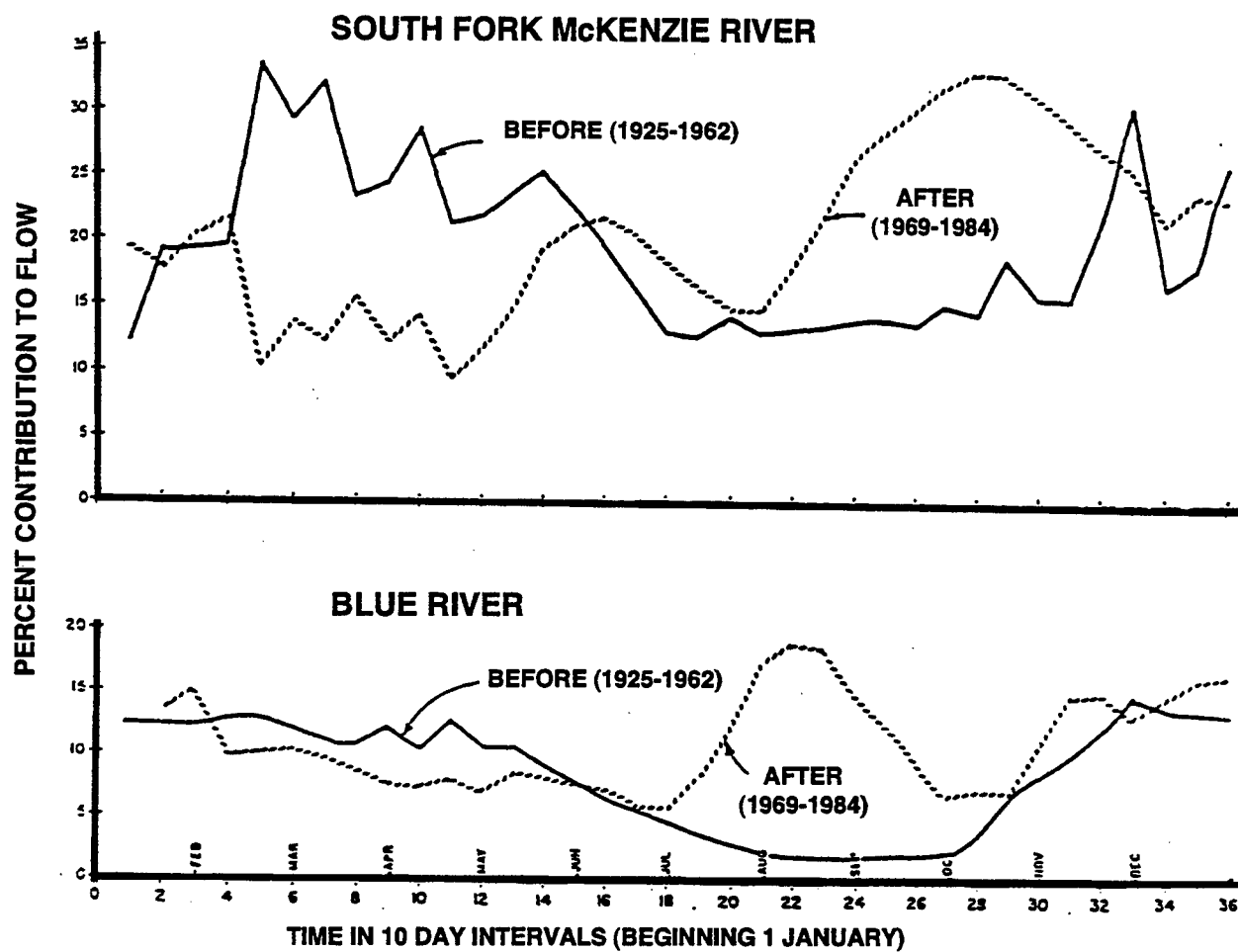


Figure 6. Pre- and post-impoundment flows in the South Fork McKenzie River and in Blue River downstream from the respective Dams. (Data from USGS gaging stations, graphs reproduced from USACE 1994)

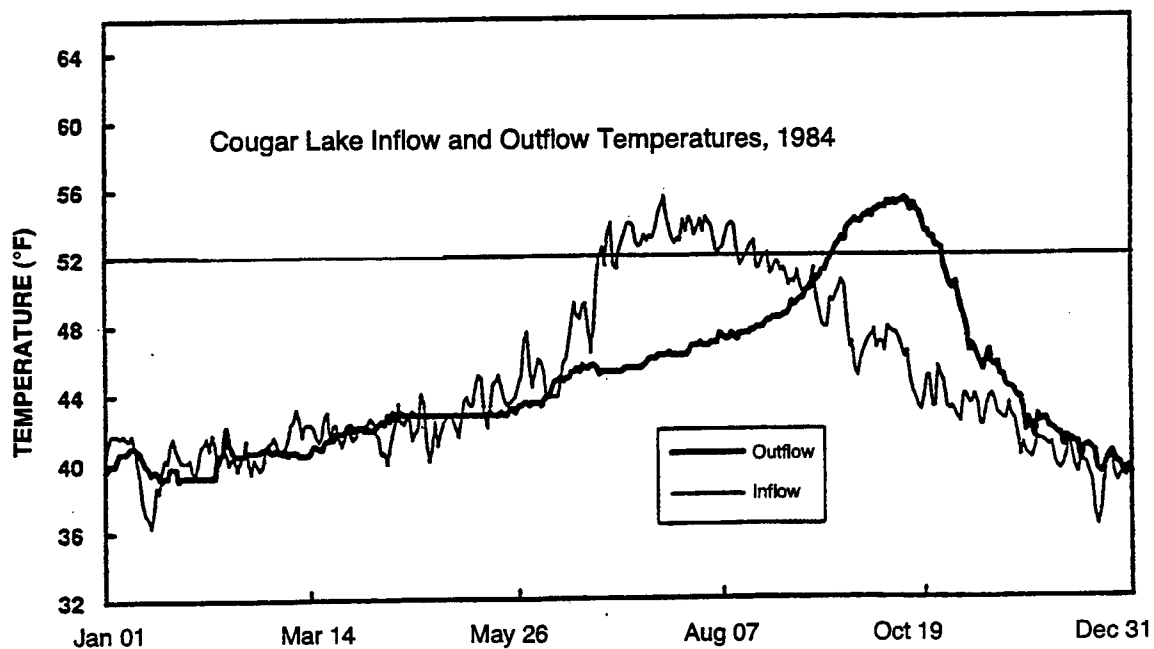
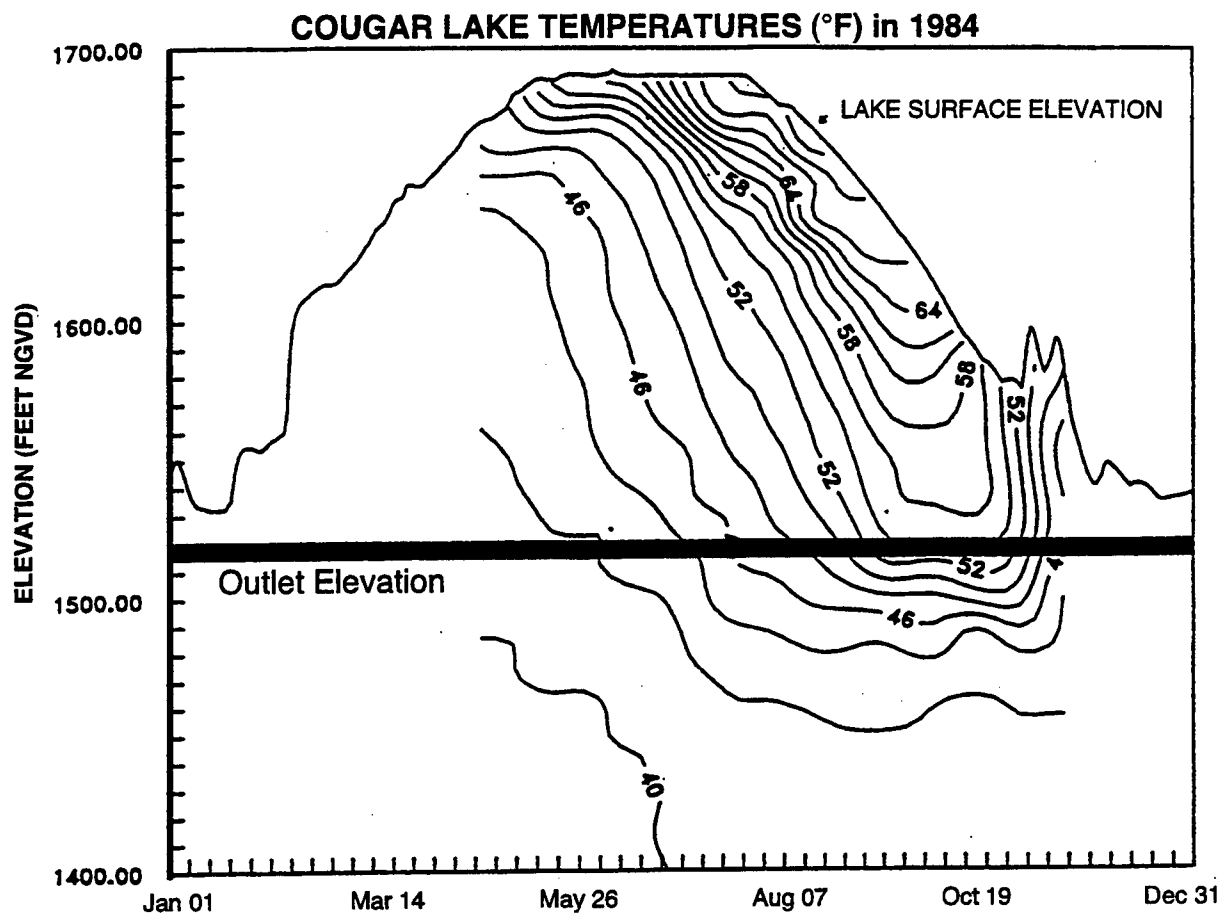


Figure 7. Plots of thermal isopleths and inflow and outflow temperatures for 1984 at Cougar Dam.
(Plots reproduced from USACE 1994)

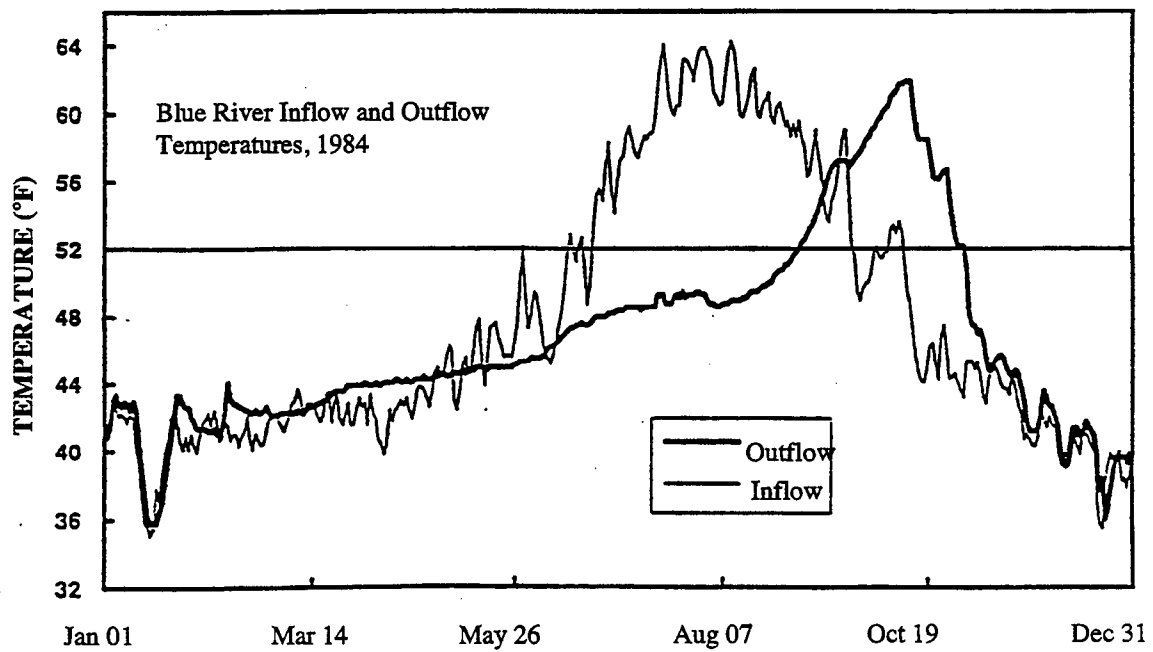
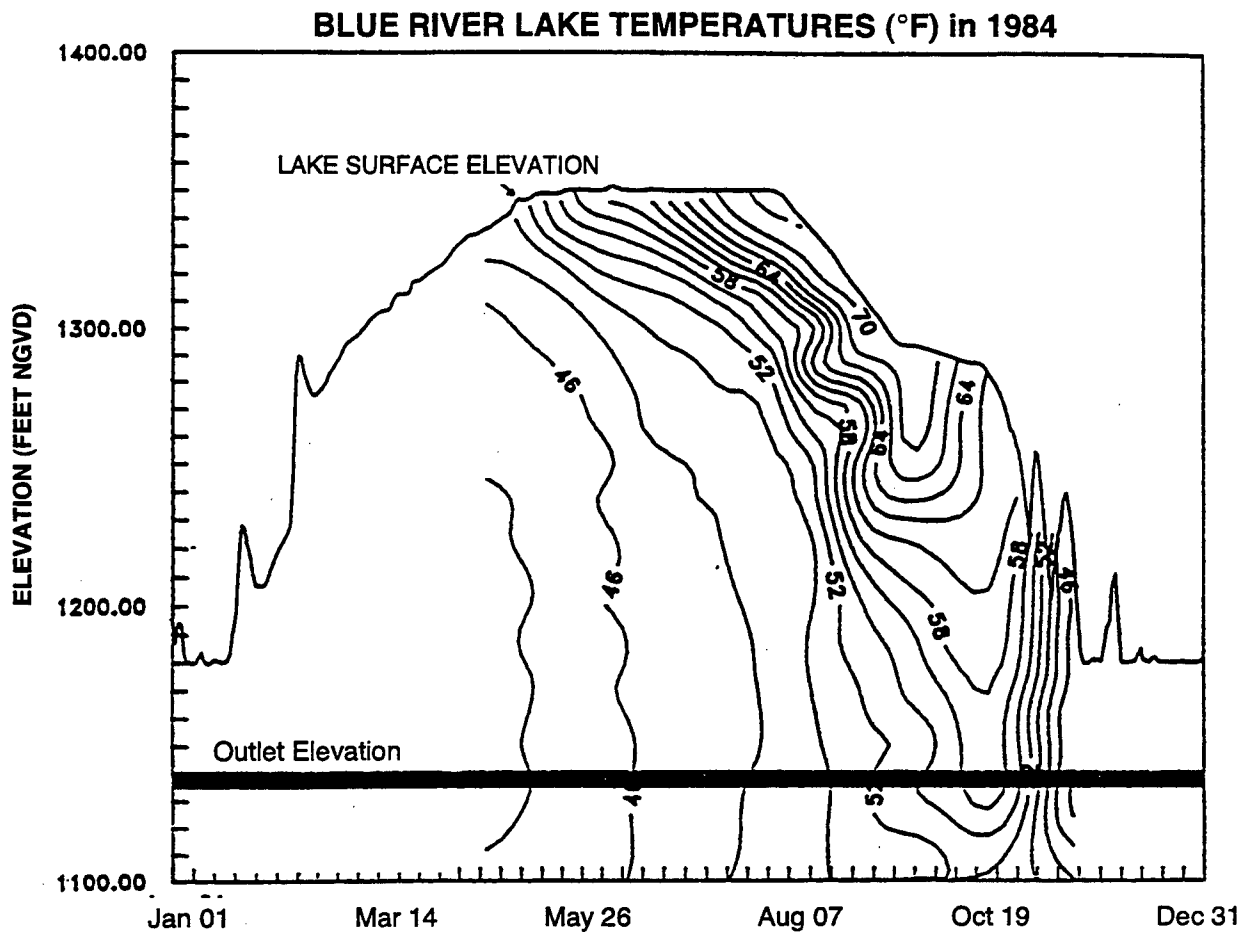
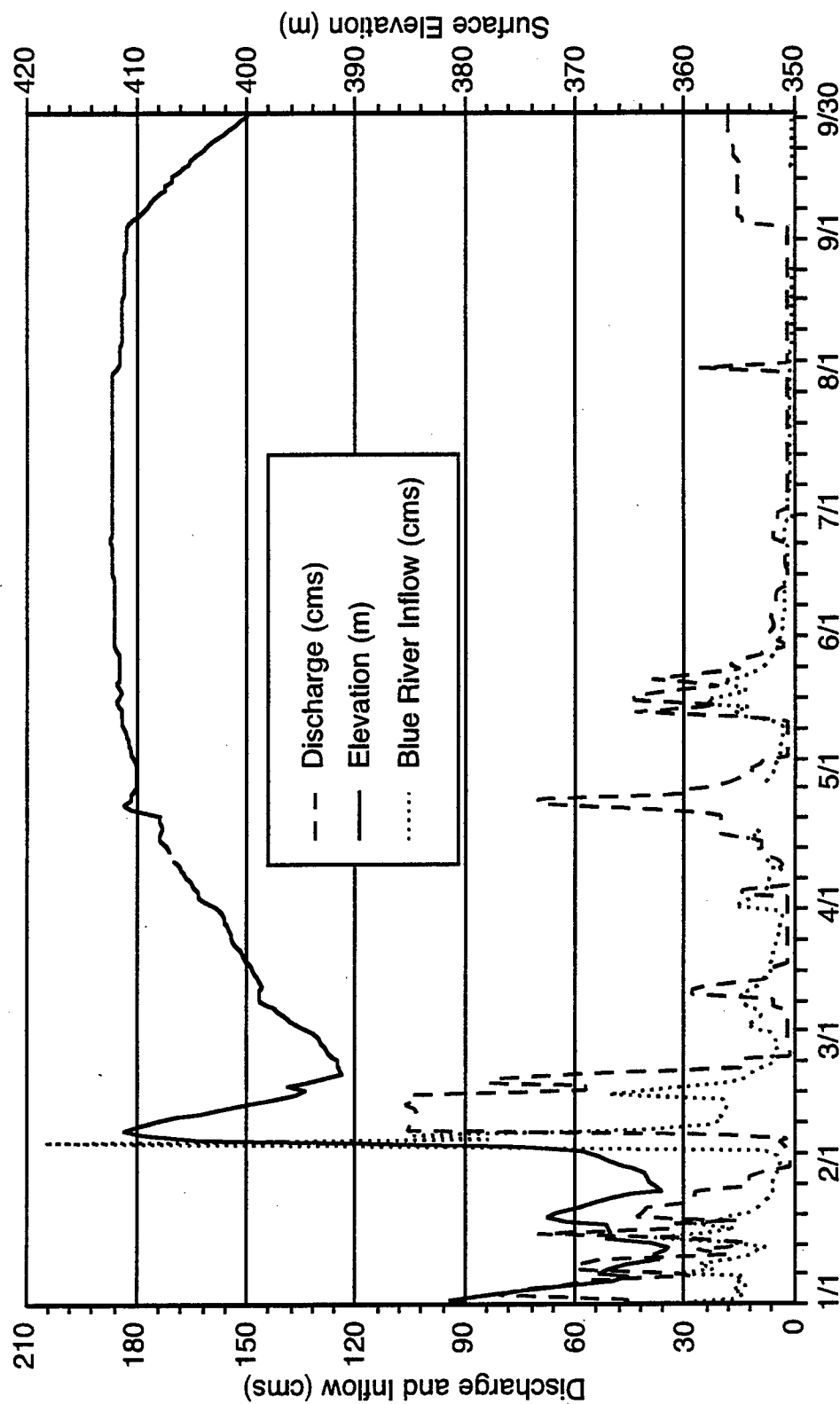
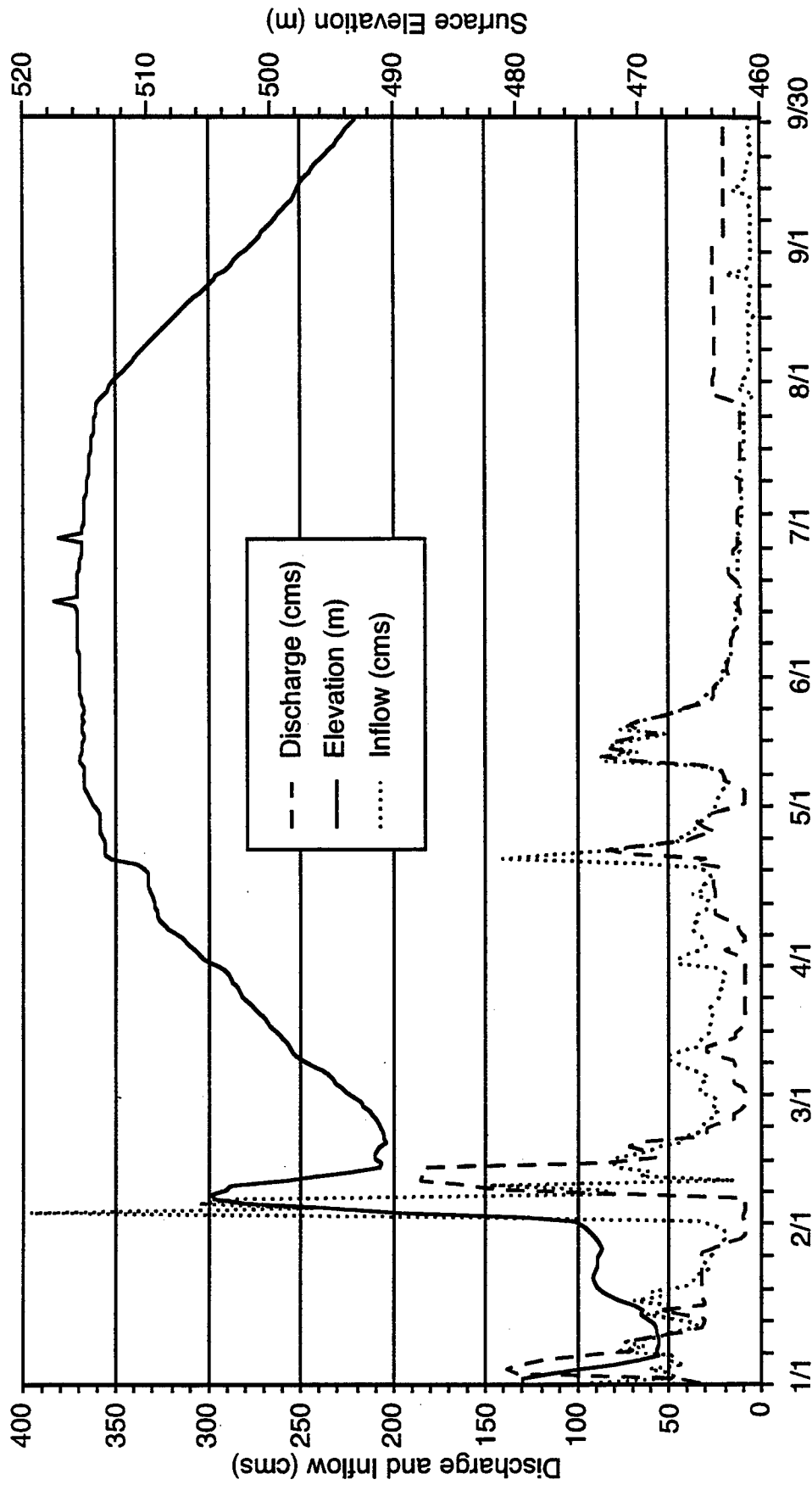


Figure 8. Plots of thermal isopleths and inflow and outflow temperatures for 1984 at Blue River Dam
(Plots reproduced from USACE 1994)



Weeks Beginning 1 January, Ending 30 September 1996

Figure 9. Hydrologic history of Blue River Lake beginning 1 January 1996 and ending 30 September 1996. A major storm event occurred during February 1996 and this is illustrated by the Blue River inflow plot as well as the change in elevation for Blue River Lake at that time



Weeks Beginning 1 January, Ending 30 September 1996

Figure 10. Hydrologic history of Cougar Lake beginning 1 January and ending 30 September 1996. A major storm event occurred during February and this is illustrated by the inflow plot for the South Fork McKenzie River as well as the change in elevation for Cougar Lake at that time

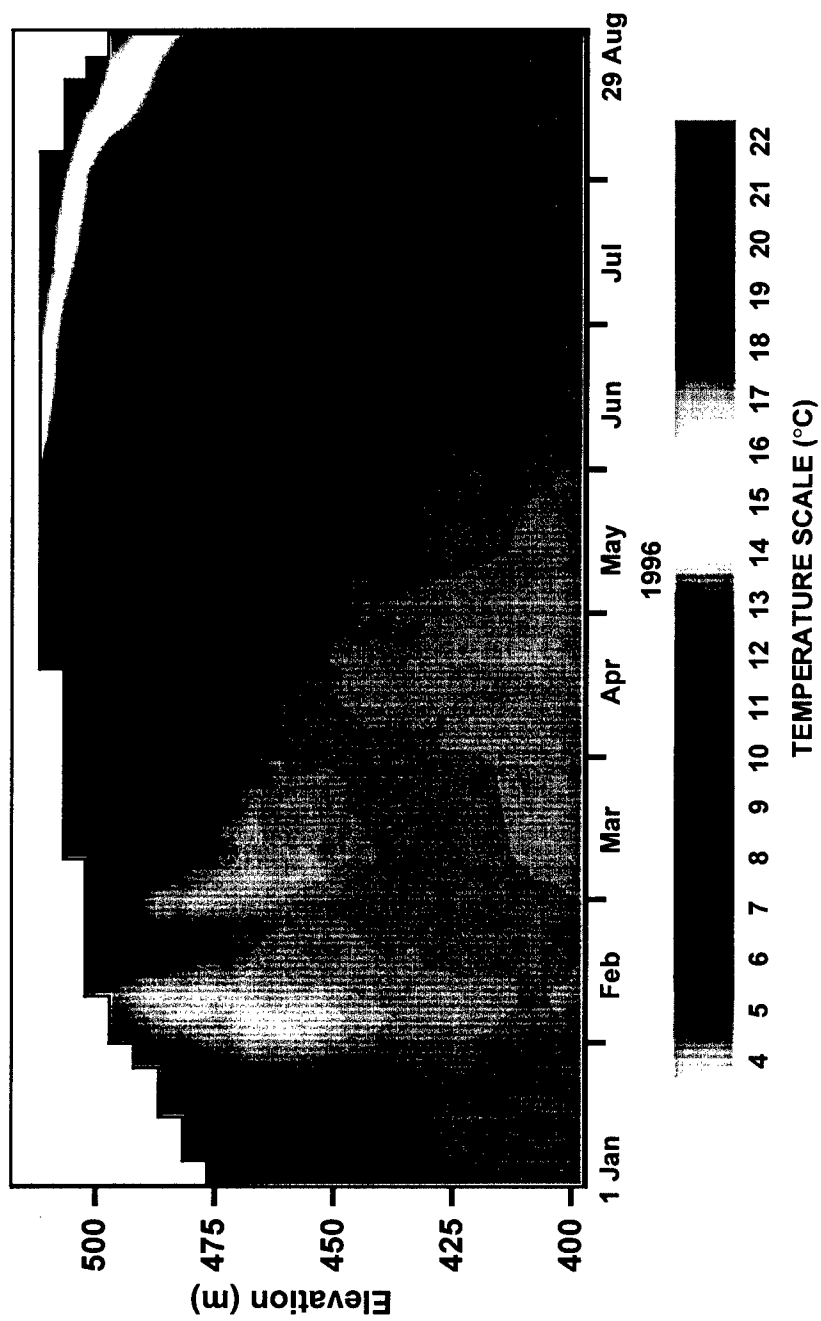


Figure 11. Thermal pattern for the continuous data logged in Cougar Lake in 1996. The logging devices were removed 29 August 1996. Data courtesy of Bob Magne, USACE-NPP.

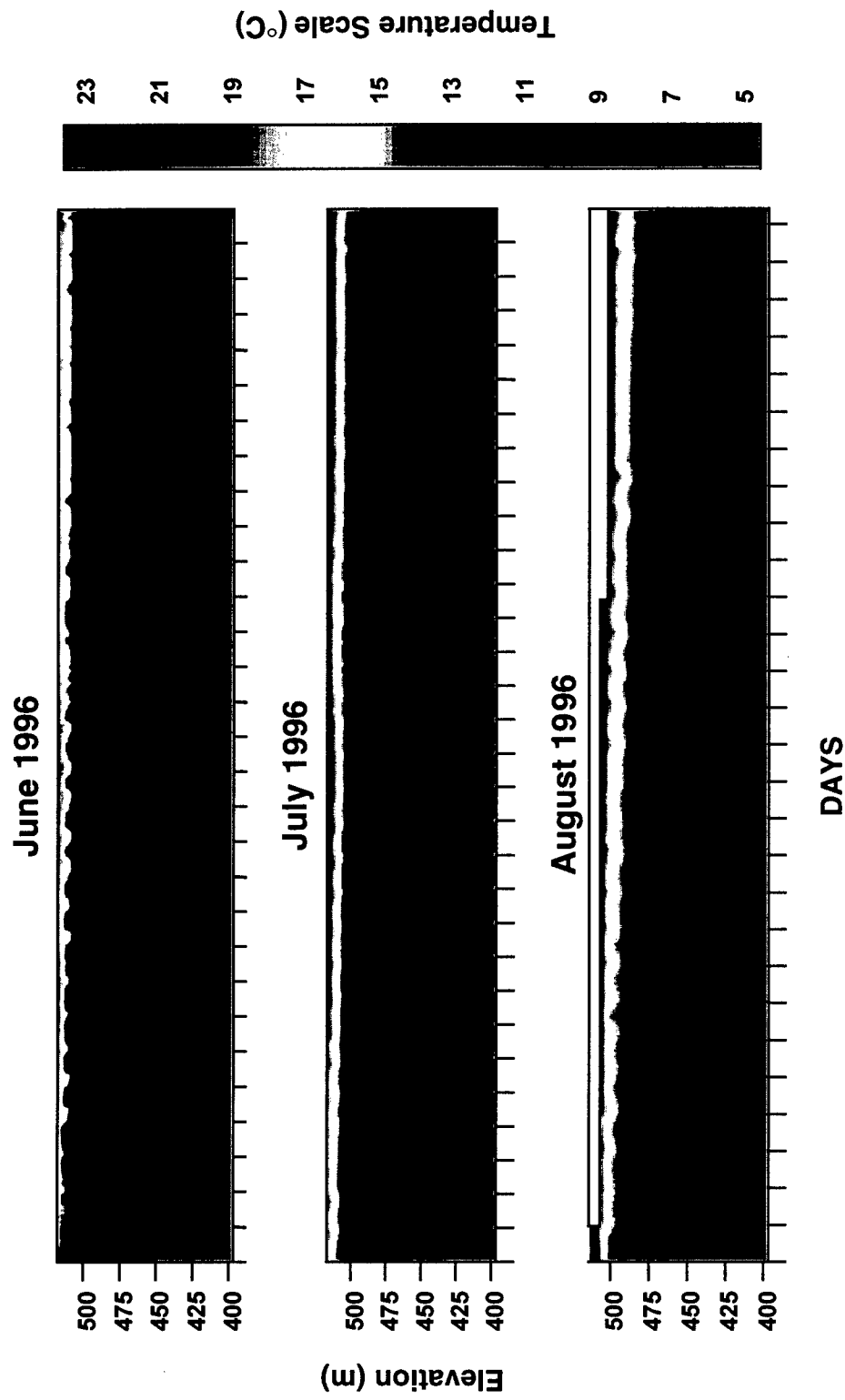


Figure 12. Thermal changes in Cougar Lake during the June, July, and August 1996. Data logged in situ using remote thermal loggers. Data courtesy of Bob Magne, USACE-NPP.

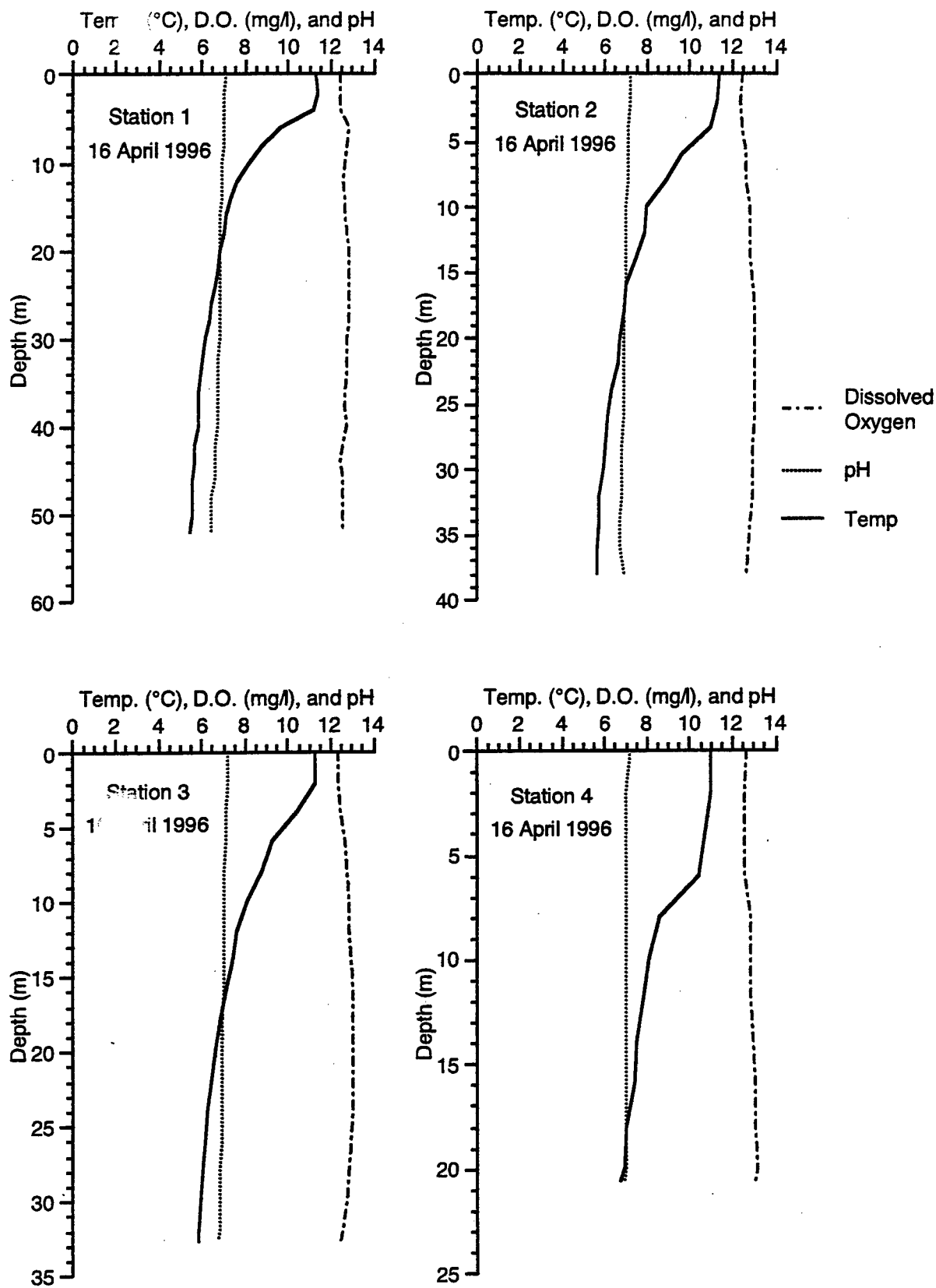


Figure 13. Temperature, dissolved oxygen concentration, and pH for four stations on Blue River Lake, April 1996

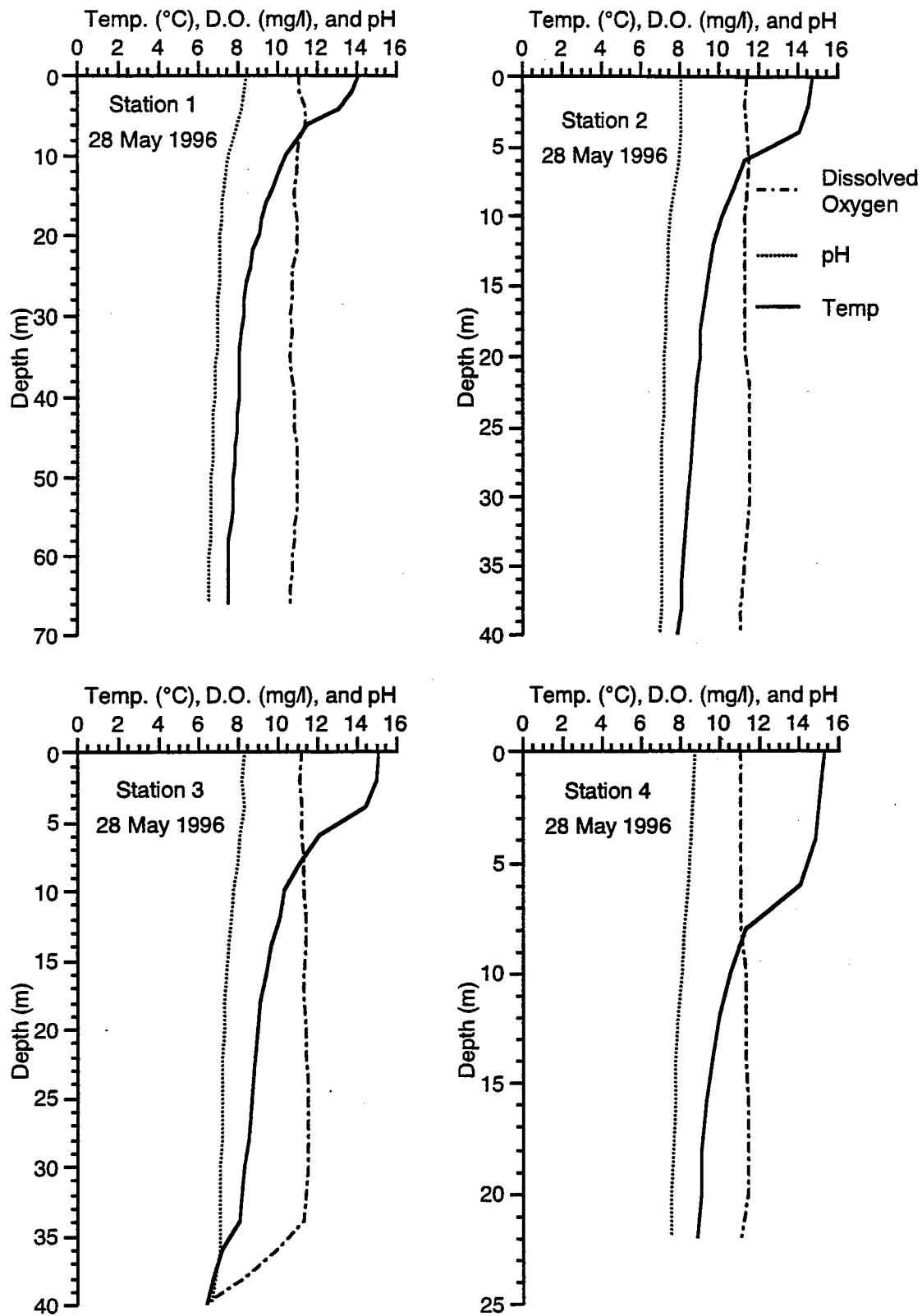


Figure 14. Temperature, dissolved oxygen concentration, and pH for four stations on Blue River Lake, May 1996

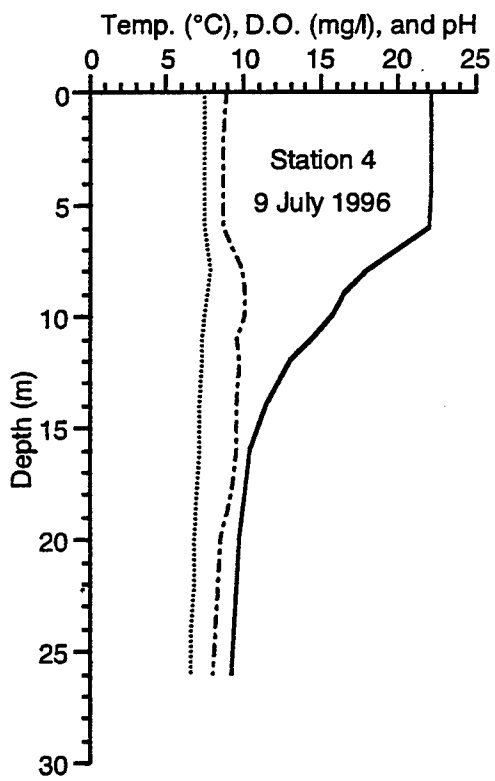
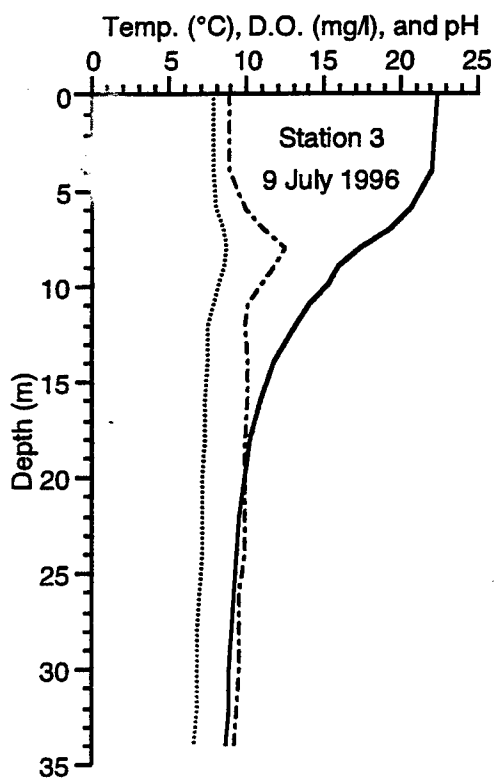
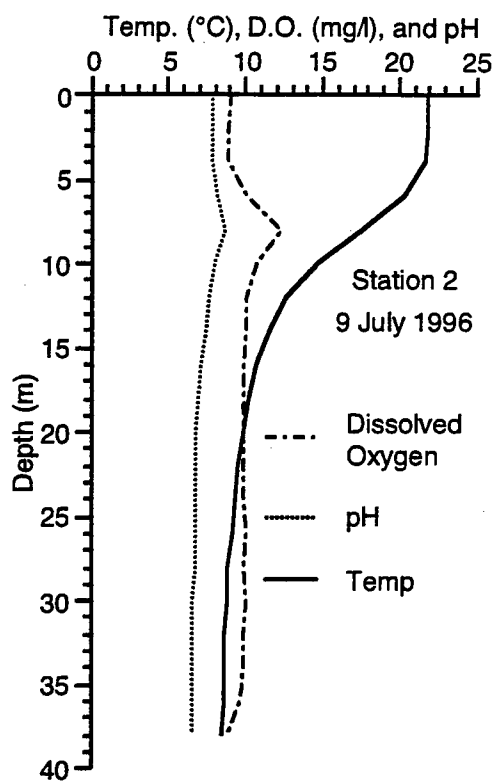
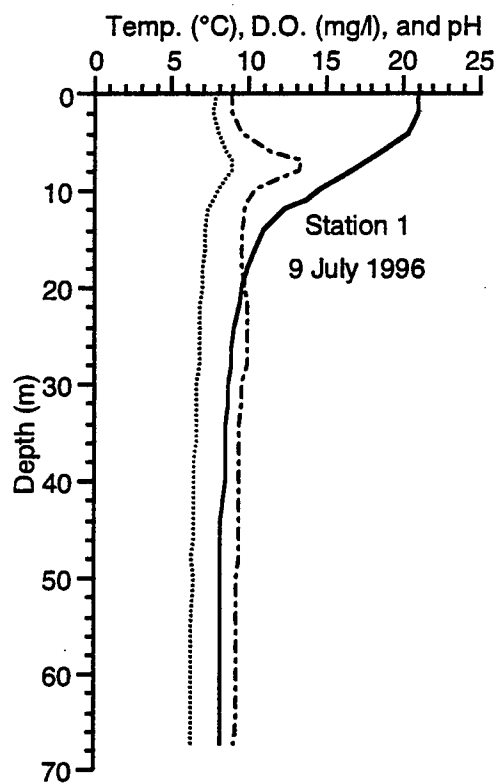


Figure 15. Temperature, dissolved oxygen concentration, and pH for four stations on Blue River Lake, July 1996

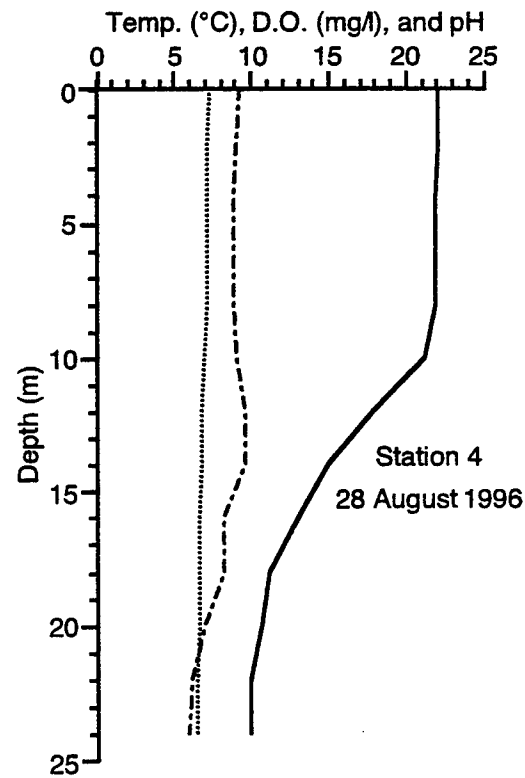
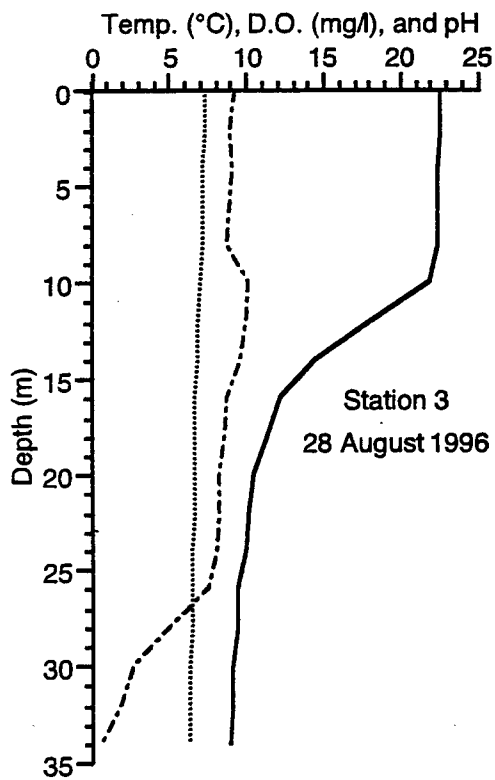
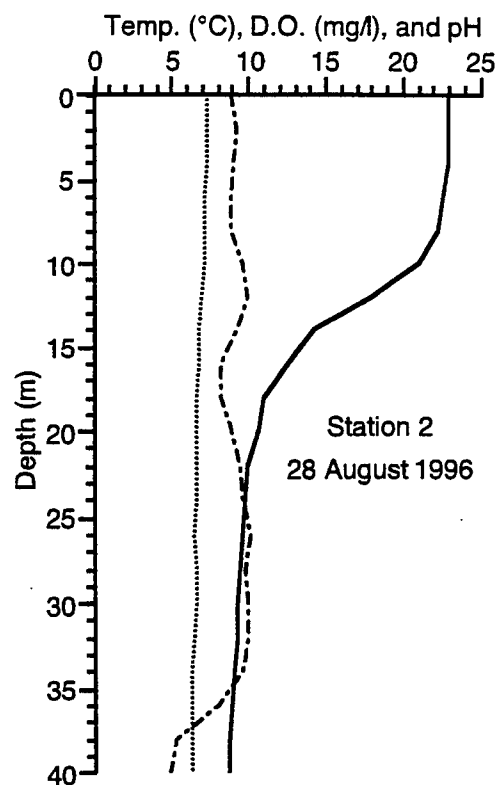
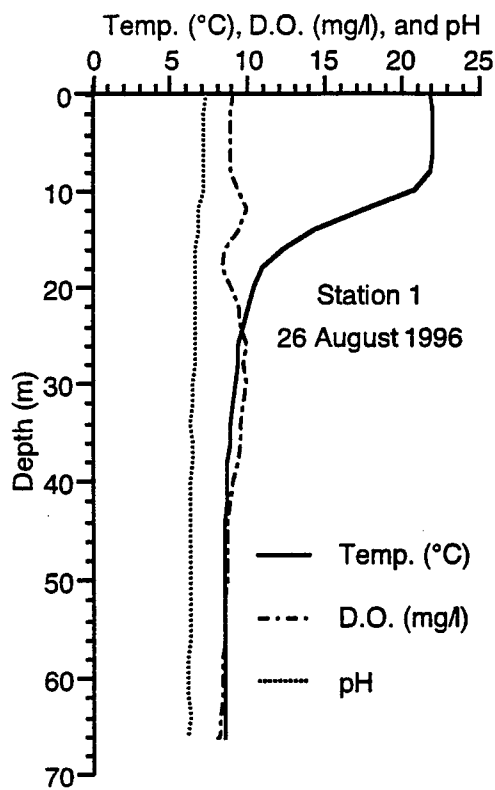


Figure 16. Temperature, dissolved oxygen concentration, and pH for four stations on Blue River Lake, August 1996

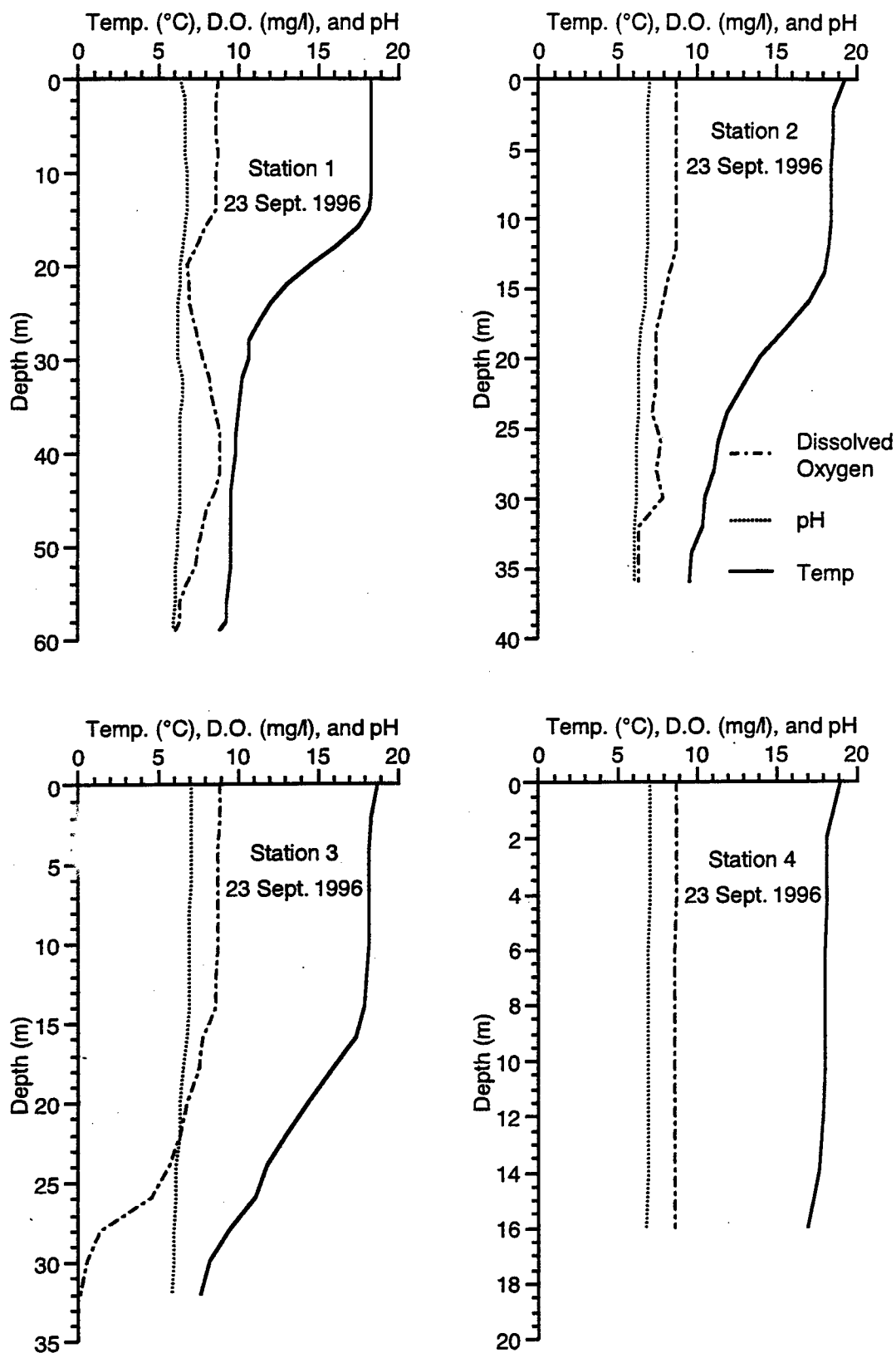


Figure 17. Temperature, dissolved oxygen concentration, and pH for four stations on Blue River Lake, September 1996

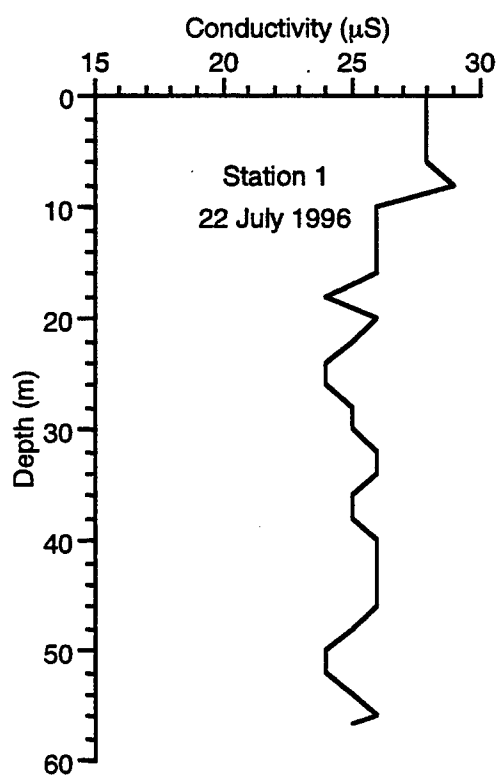
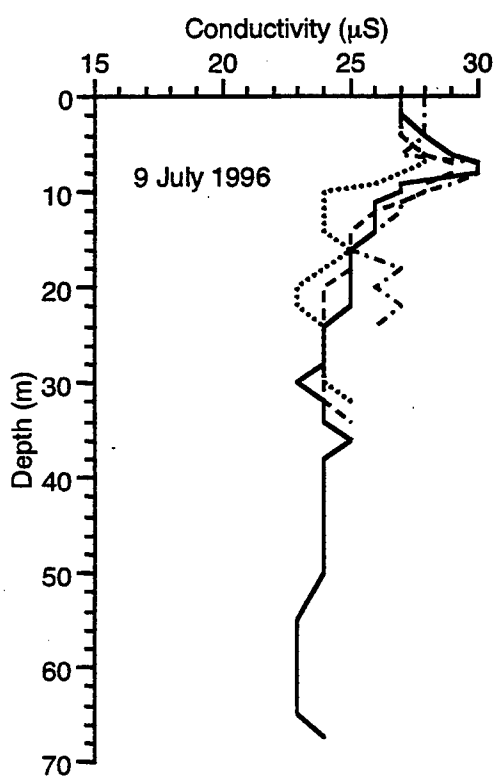
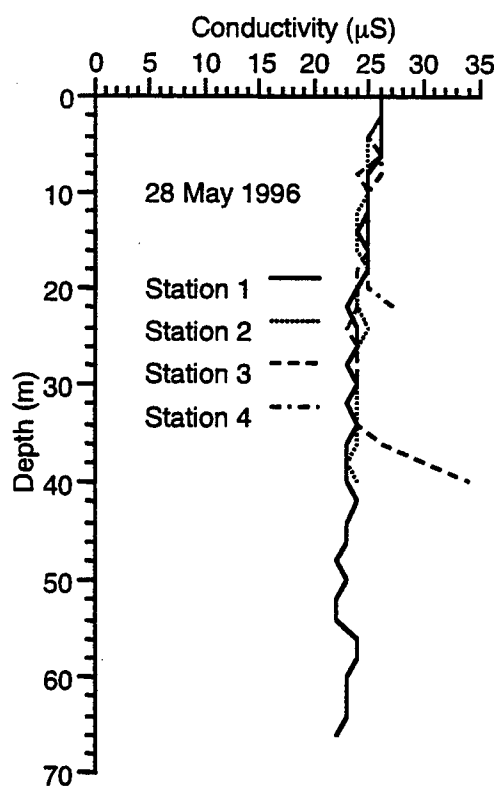
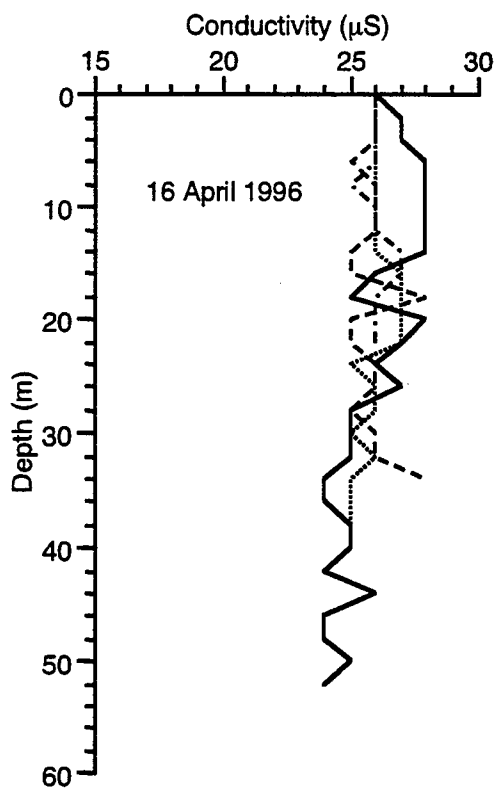


Figure 18. Conductivity plots for Blue River Lake in April - September 1996

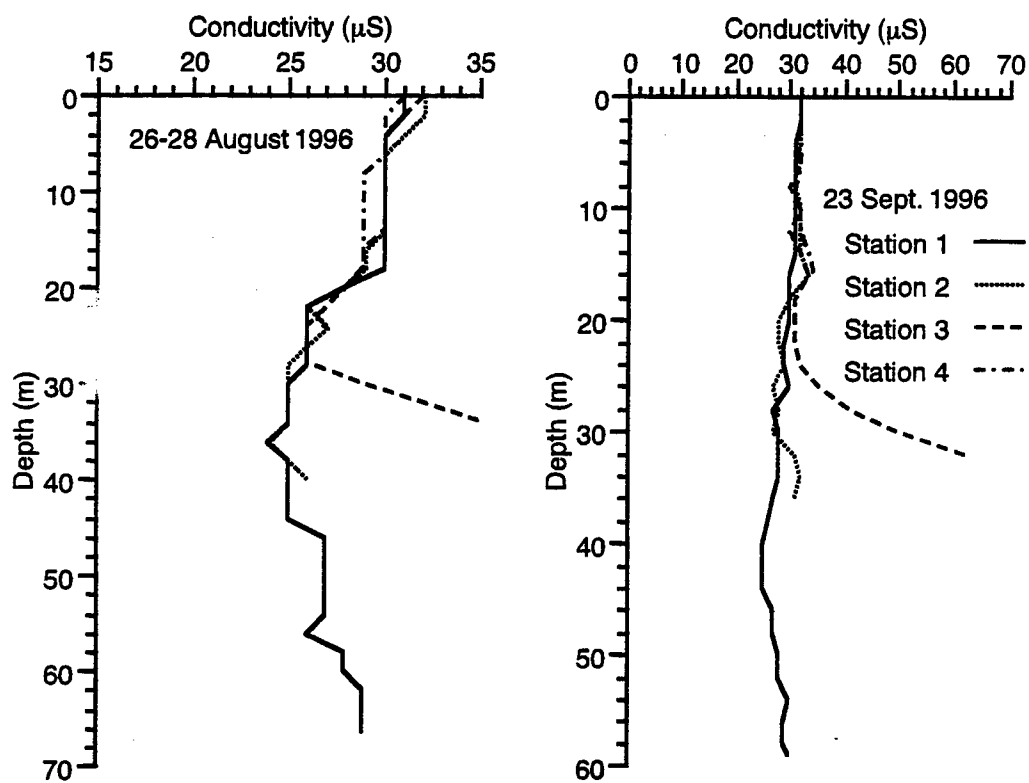


Figure 18. cont'd. Conductivity plots for Blue River Lake in April - September 1996

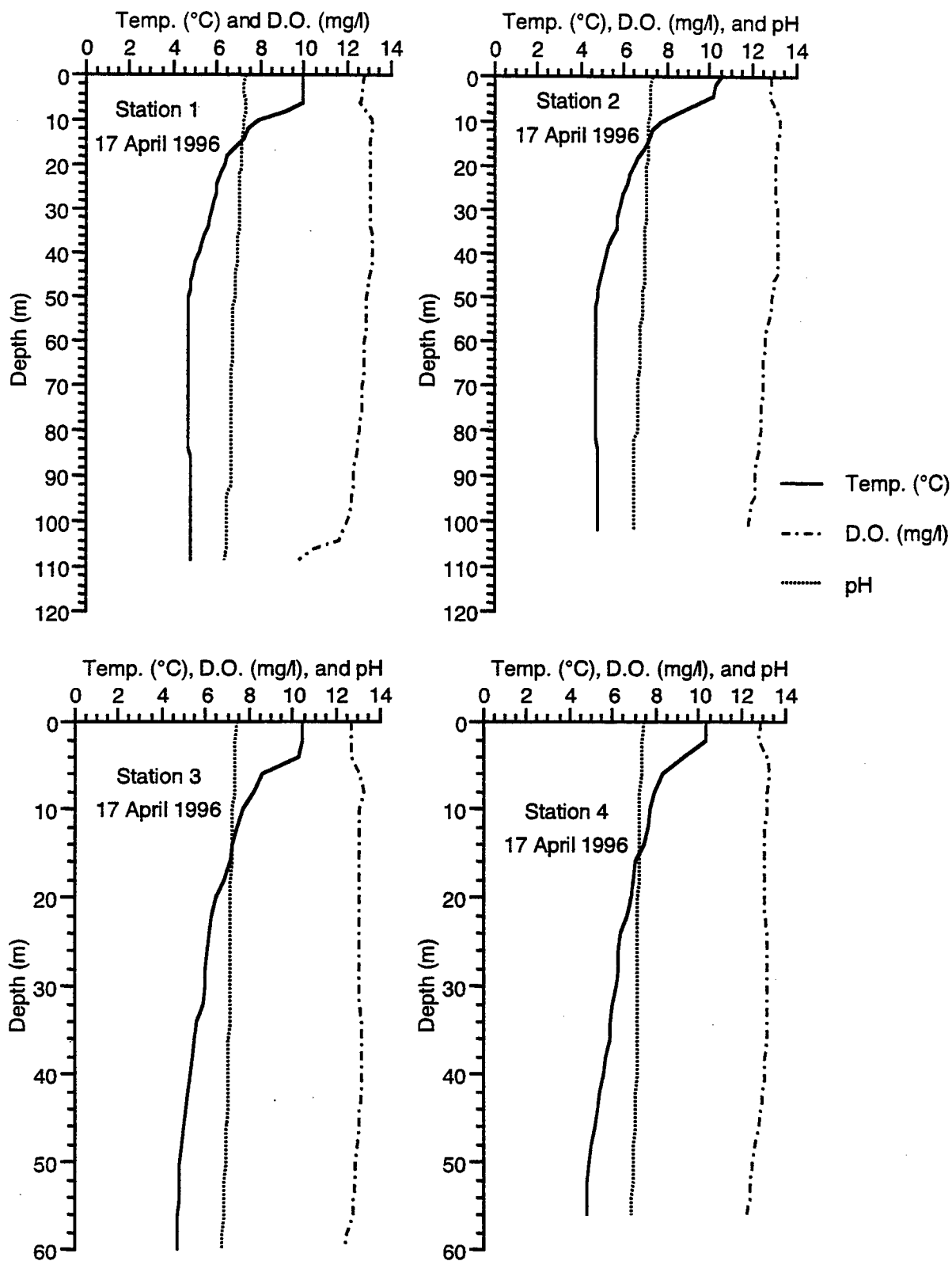


Figure 19. Temperature, dissolved oxygen concentration, and pH for four stations in Cougar Lake, April 1996

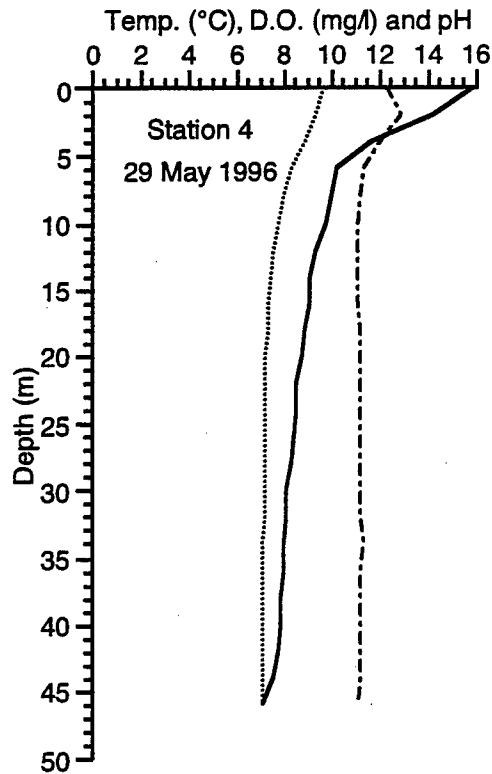
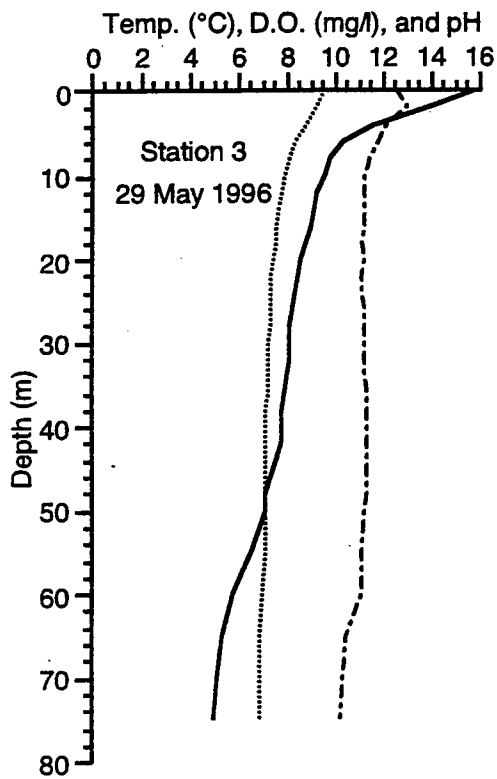
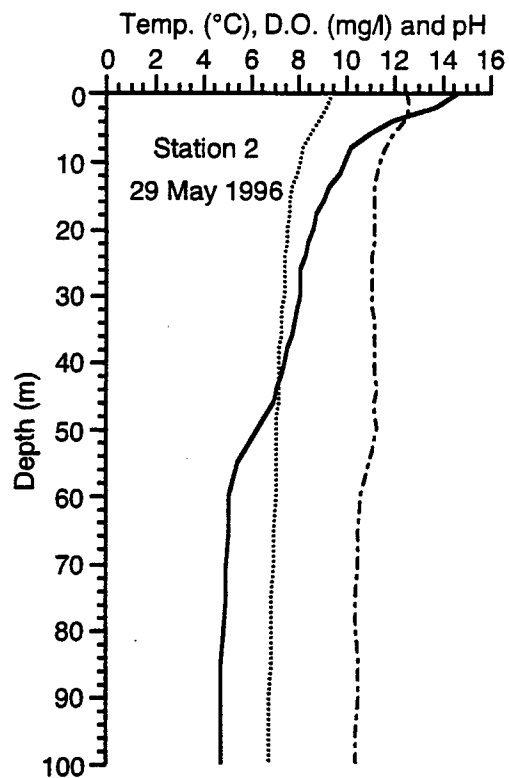
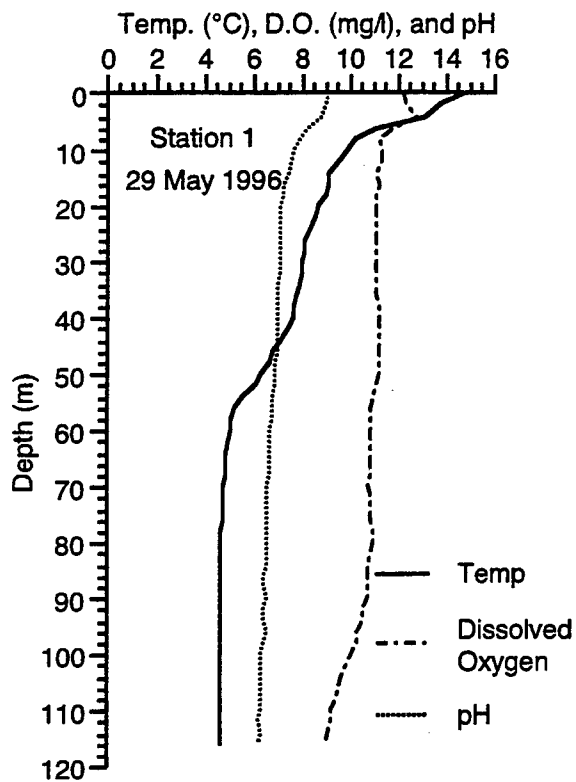


Figure 20. Temperature, dissolved oxygen concentration, and pH for four stations in Blue River Lake, May 1996.

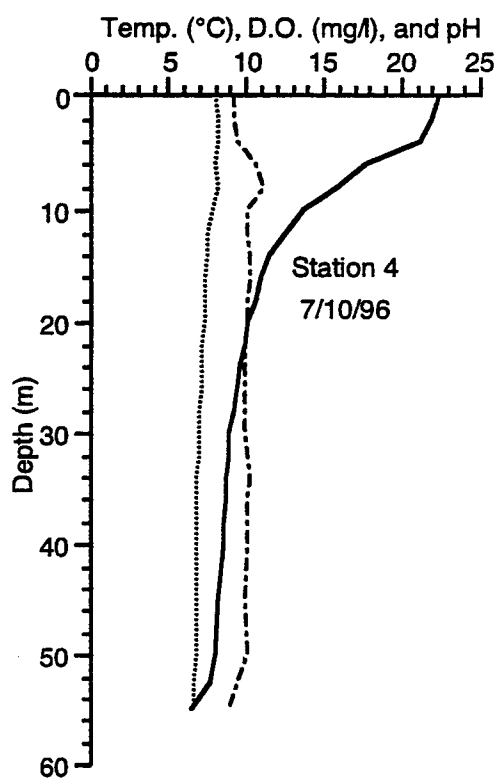
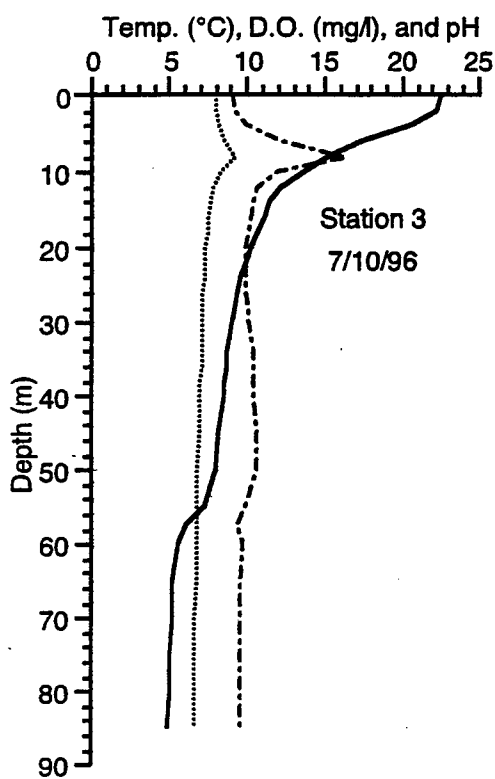
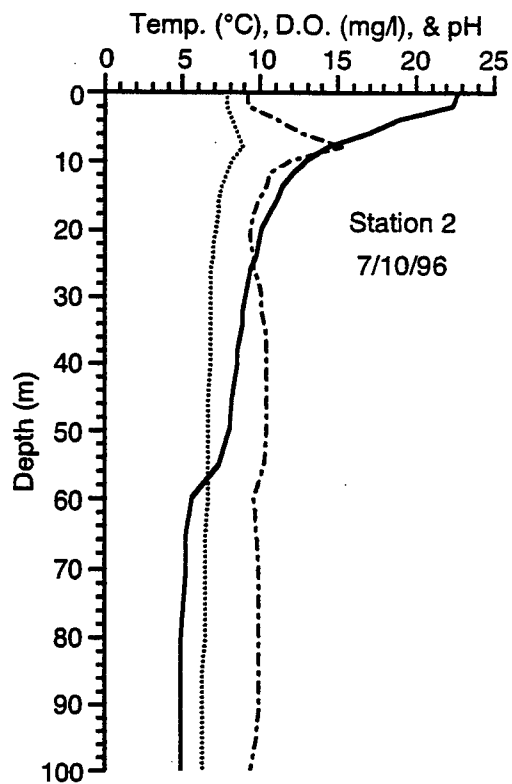
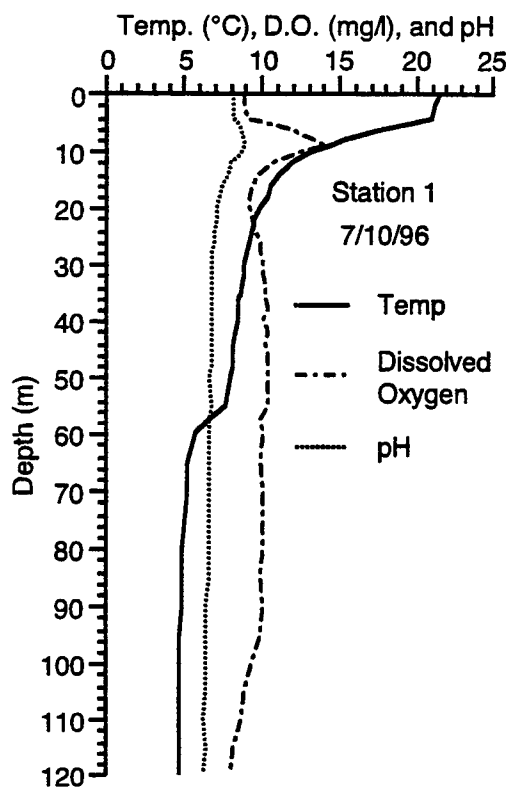


Figure 21. Temperature, dissolved oxygen concentration, and pH for four stations in Cougar Lake, July 1996

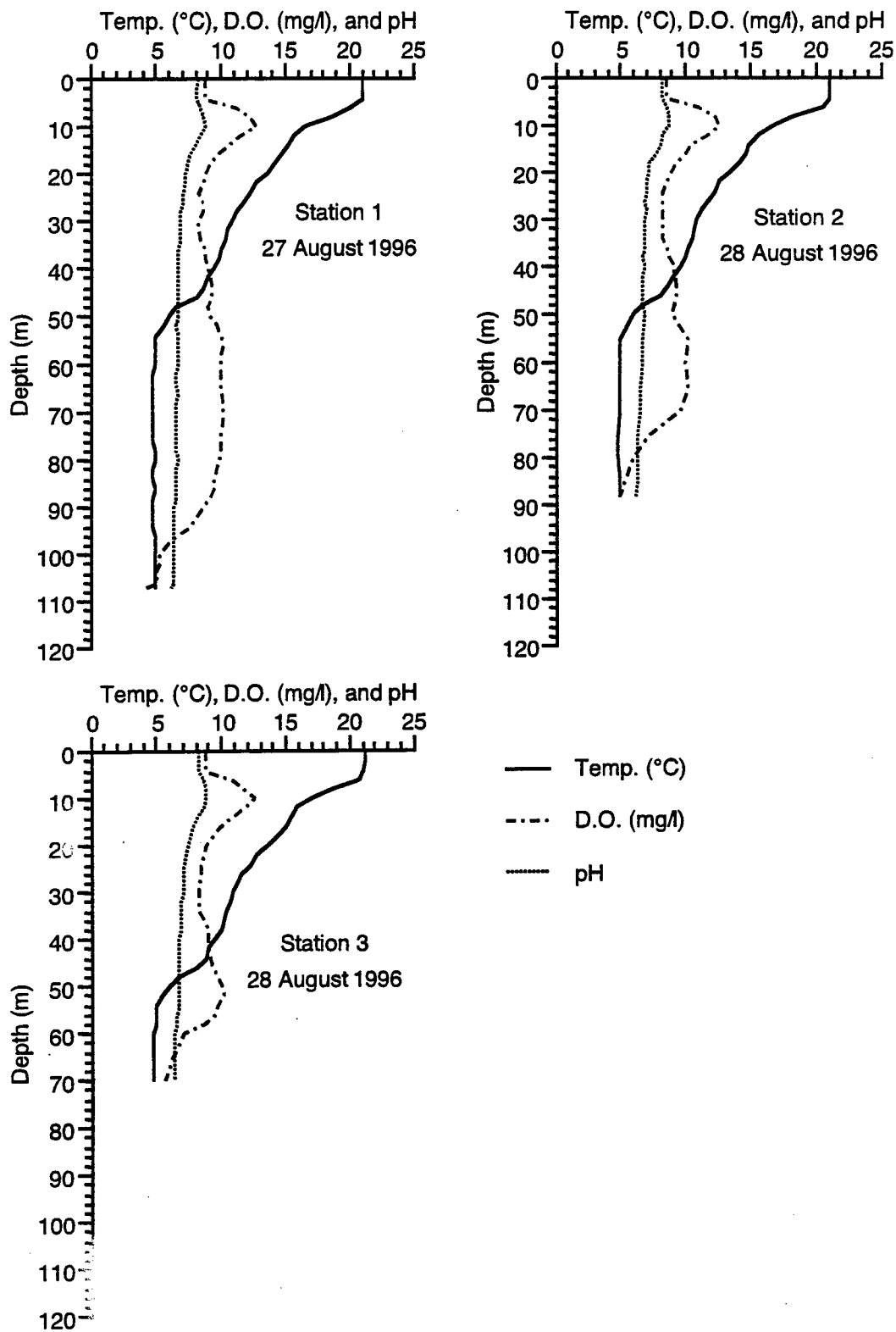


Figure 22. Temperature, dissolved oxygen concentration, and pH for three stations on Cougar Lake, August 1996

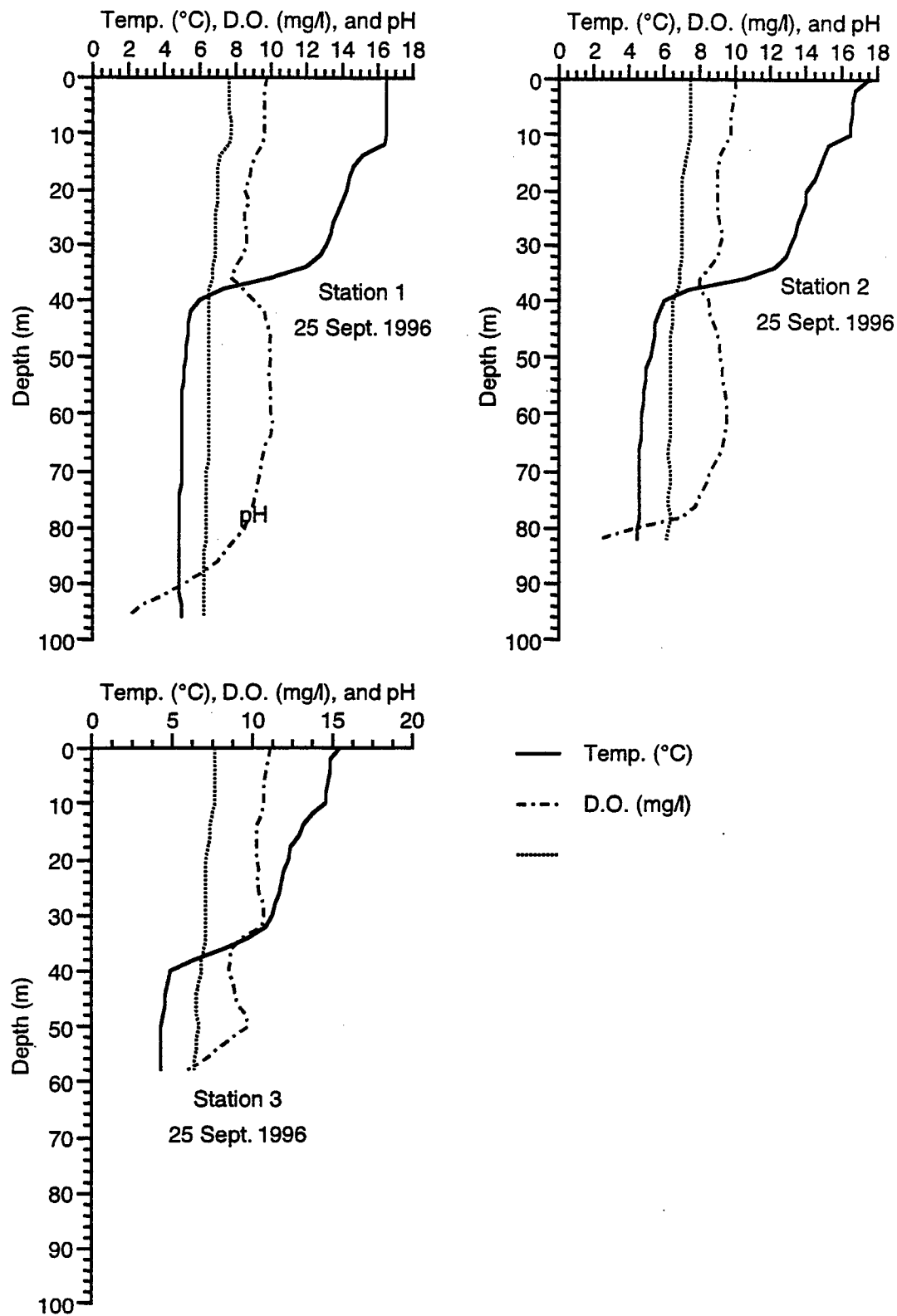


Figure 23. Temperature, dissolved oxygen concentration, and pH for three stations in Cougar Lake, September 1996

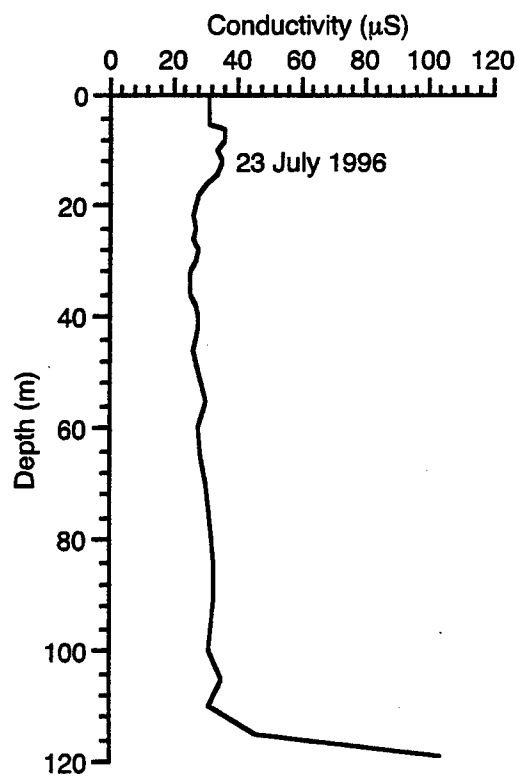
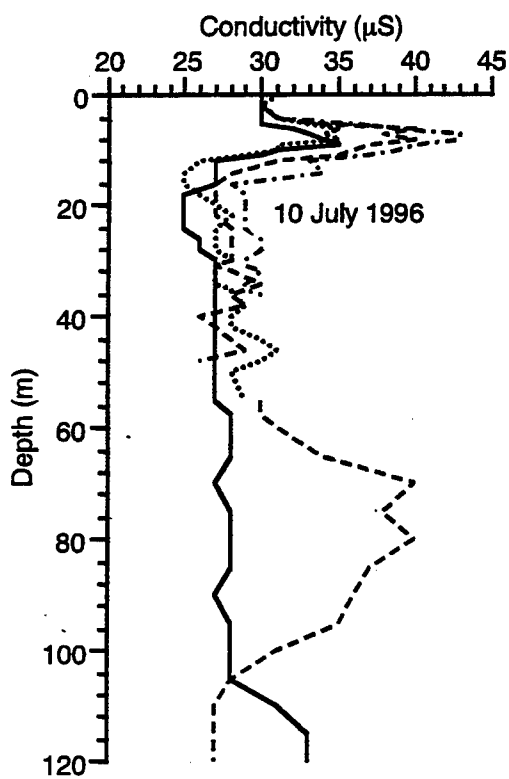
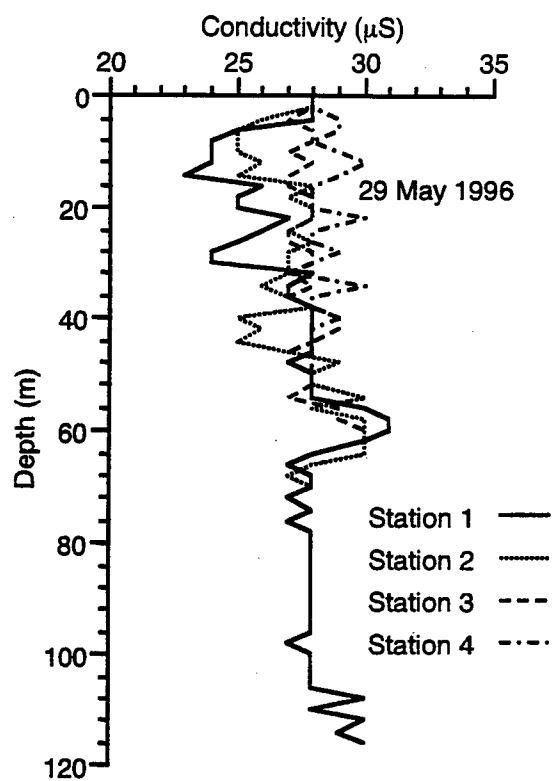
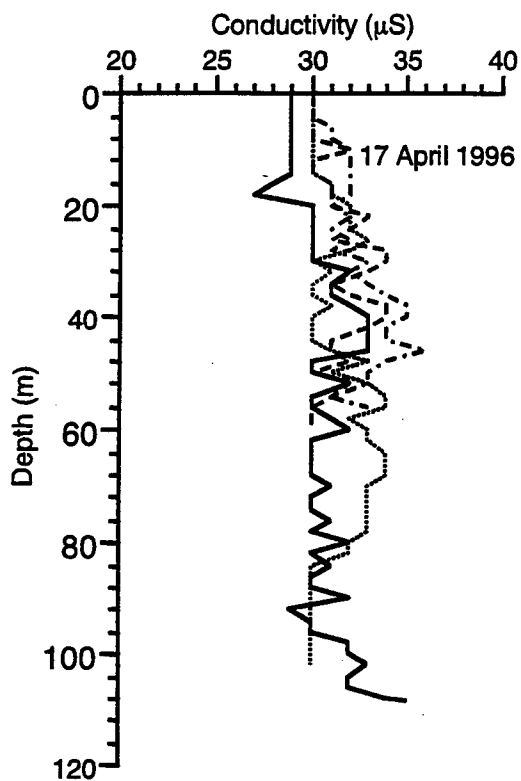


Figure 24. Specific conductance at four stations in Cougar Lake, April - September 1996.

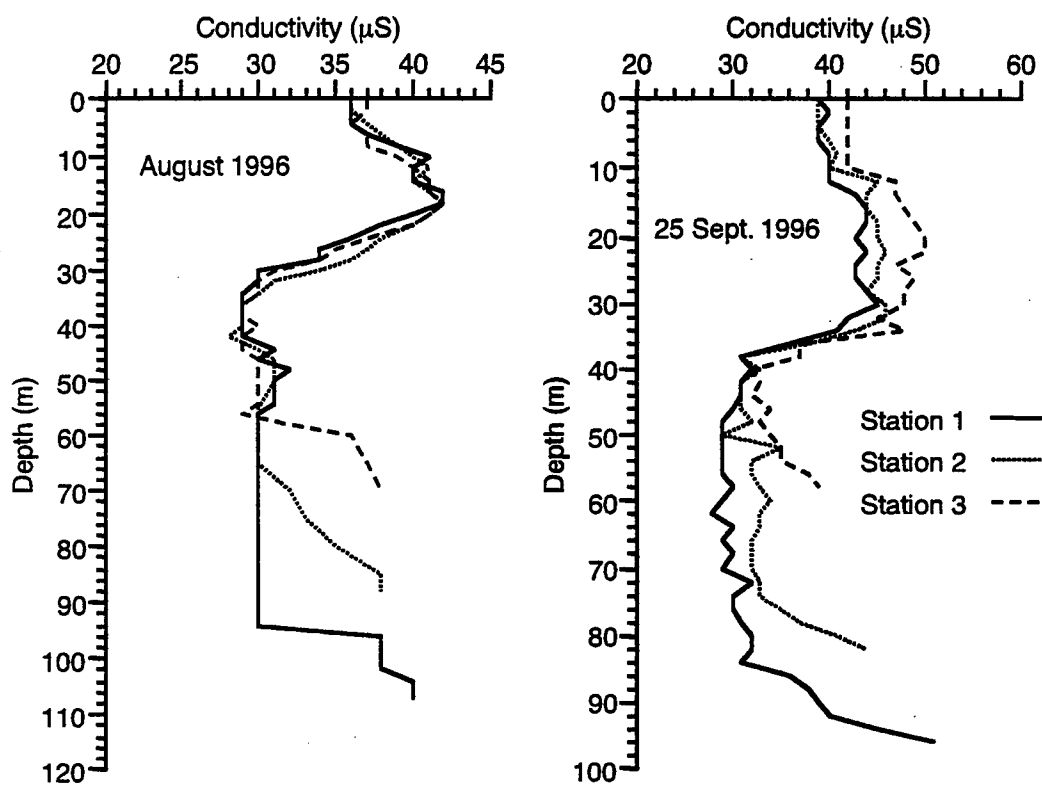


Figure 24. cont'd. Specific conductance at four stations in Cougar Lake, April - September 1996

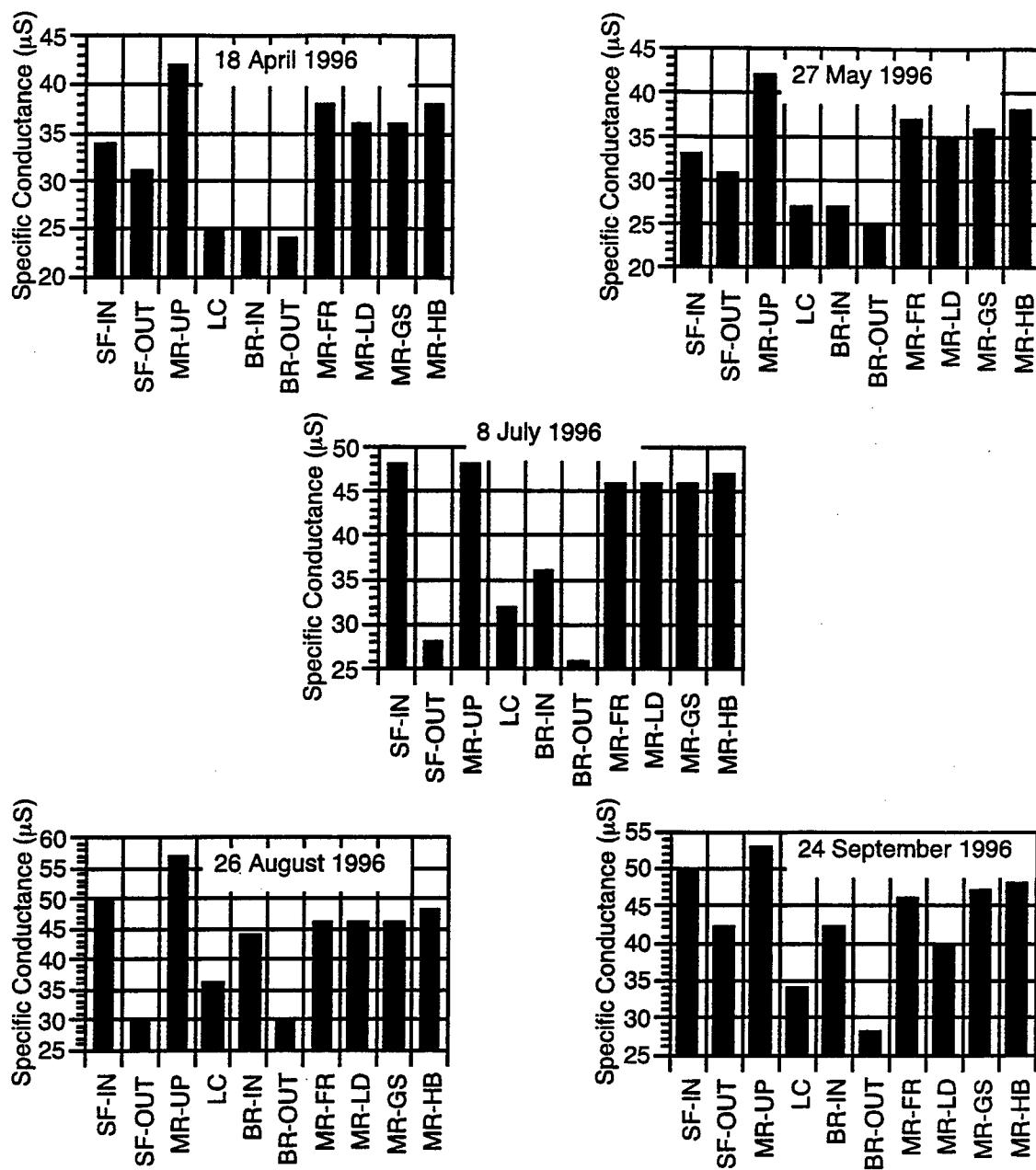


Figure 25. Specific conductance distributions in the McKenzie River system associated with Cougar and Blue River projects. Station designations are listed in Table 2

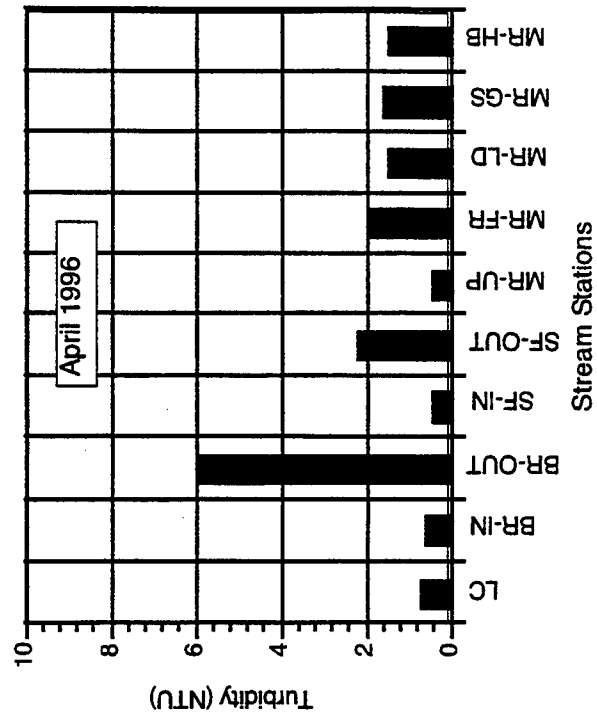
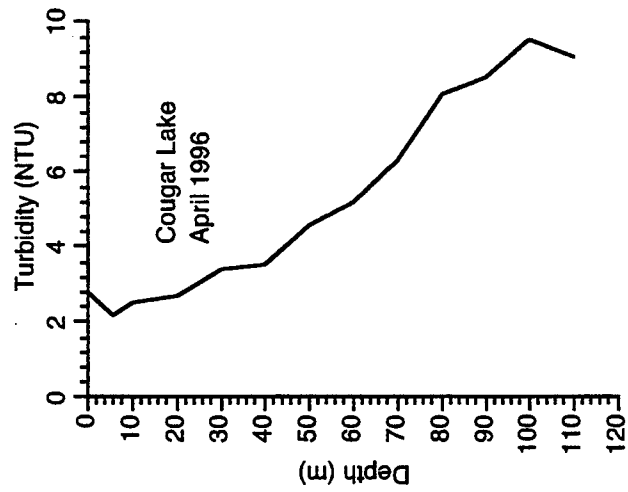
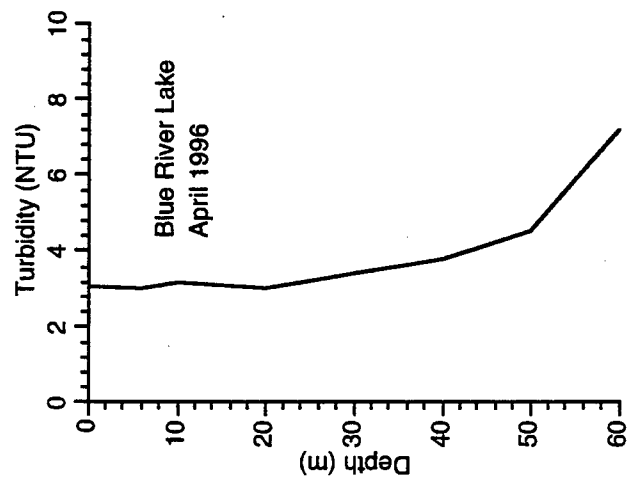


Figure 26. Patterns of turbidity in Blue River Lake, Cougar Lake, and the McKenzie River system for April 1996

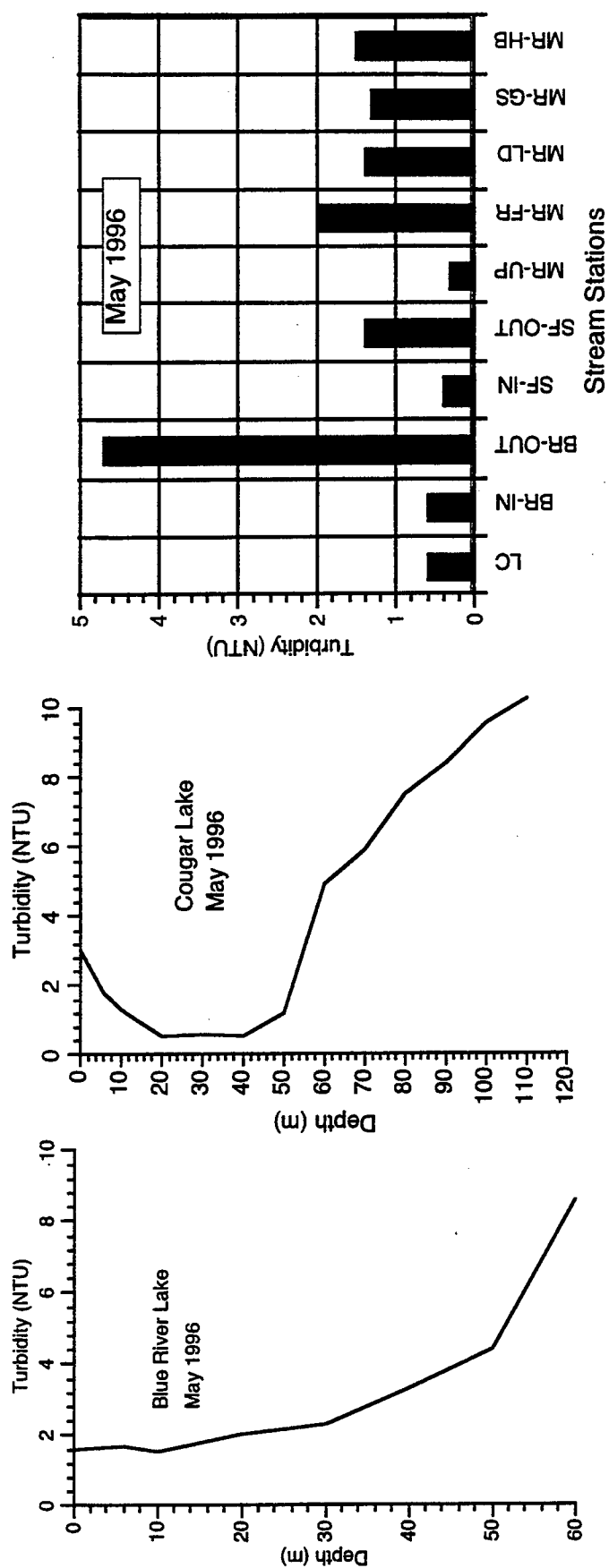


Figure 27. Patterns of turbidity in Blue River Lake, Cougar Lake, and the McKenzie River system for May 1996

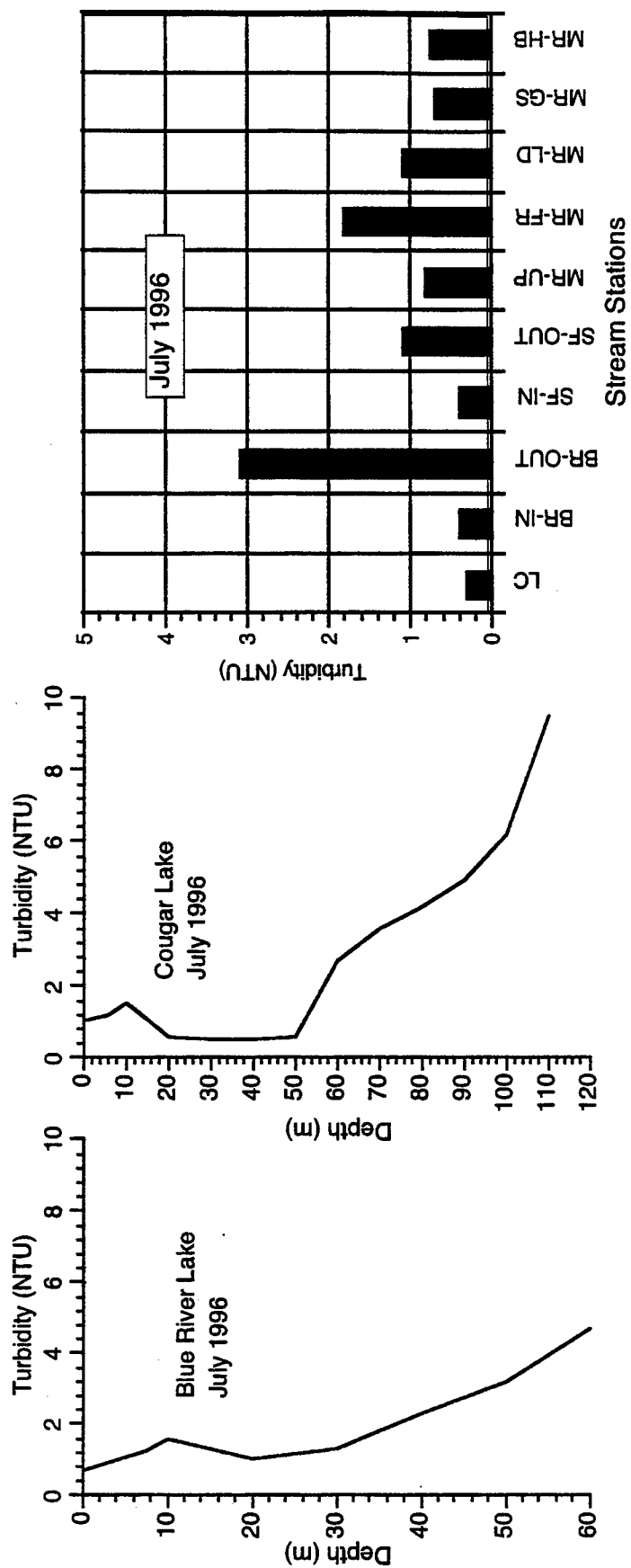


Figure 28. Patterns of turbidity in Blue River Lake, Cougar Lake, and the McKenzie River system for July 1996.

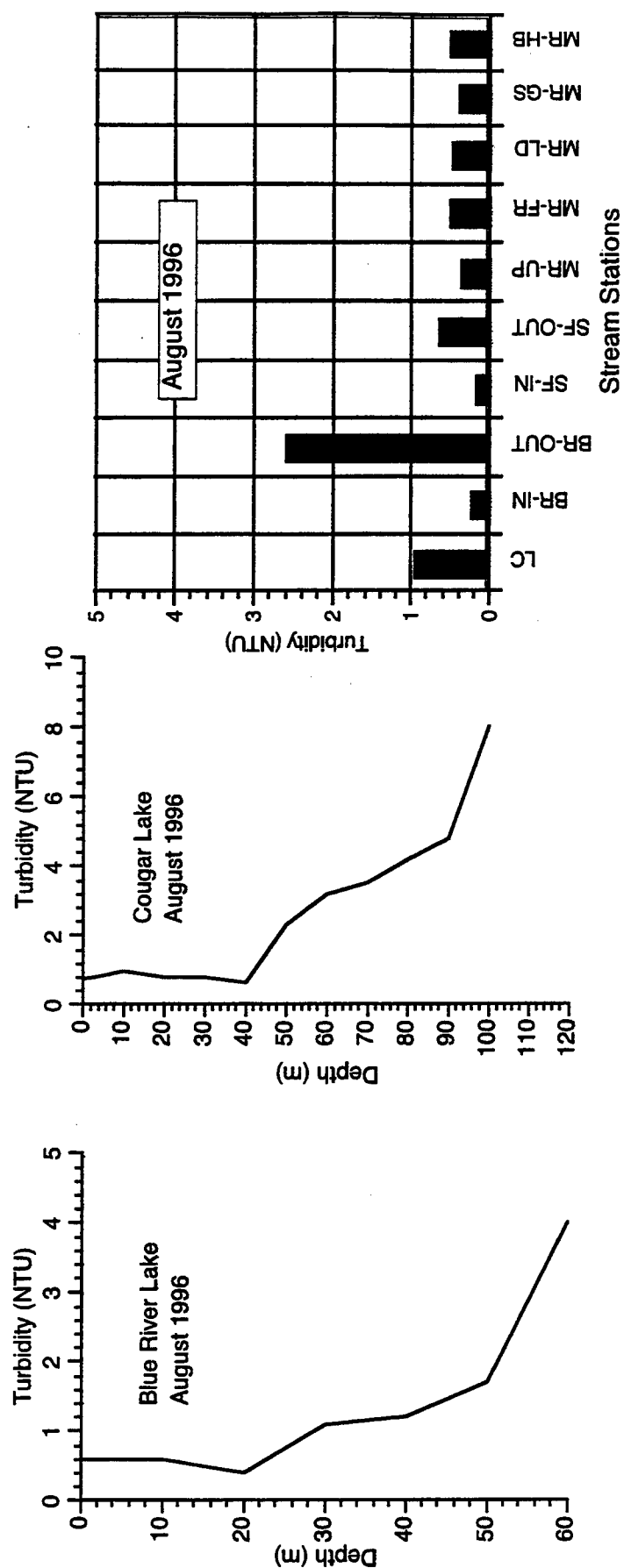


Figure 29. Patterns of turbidity in Blue River Lake, Cougar Lake, and the McKenzie River system for August 1996

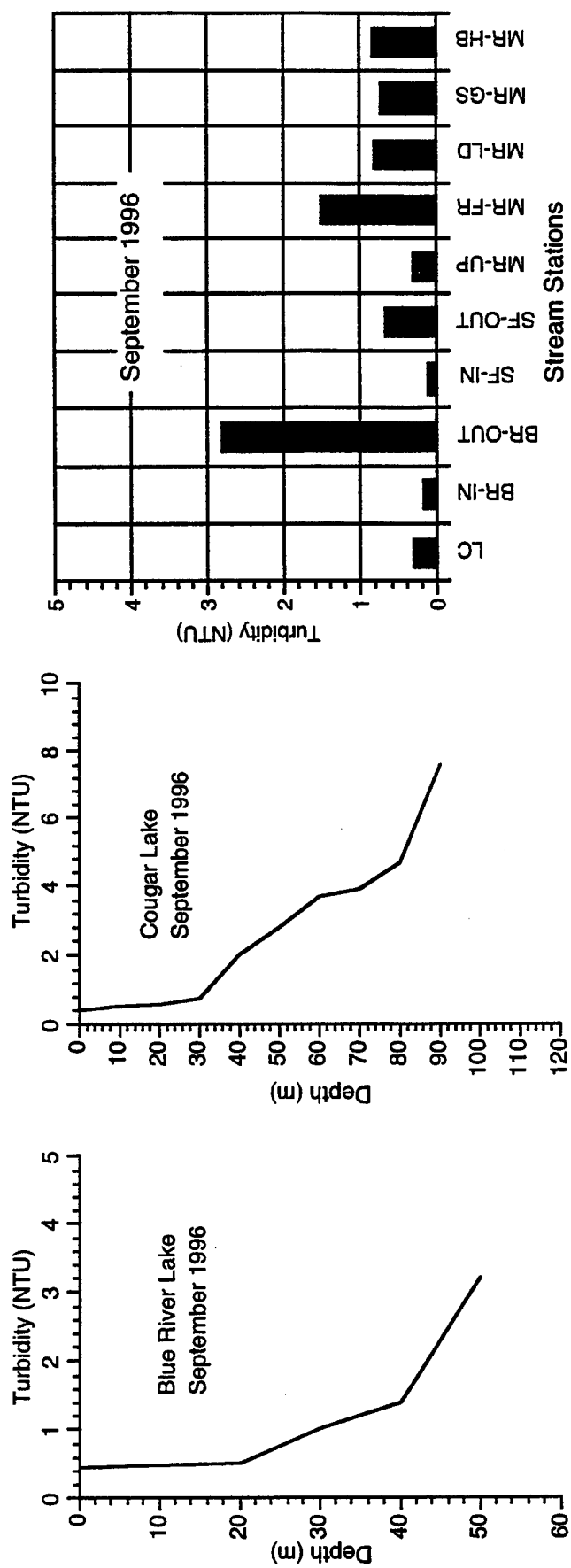


Figure 30. Patterns of turbidity in Blue River Lake, Cougar Lake, and the McKenzie River system for September 1996.

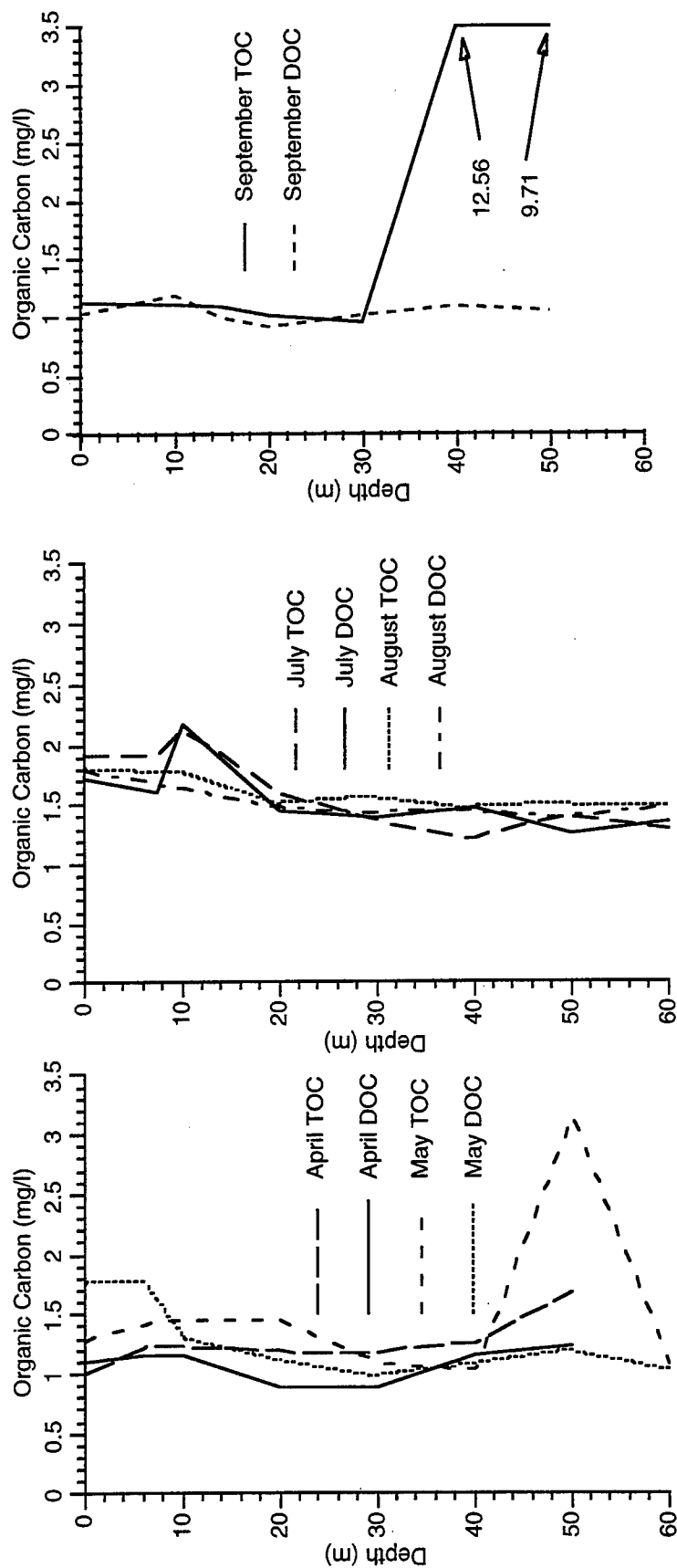


Figure 31. Organic carbon distributions in Blue River Lake in April - September 1996 showing that dissolved organic carbon is the greatest fraction of the total for most times, locations, and depths. Note the exceptional TOC concentrations at the bottom depths in September

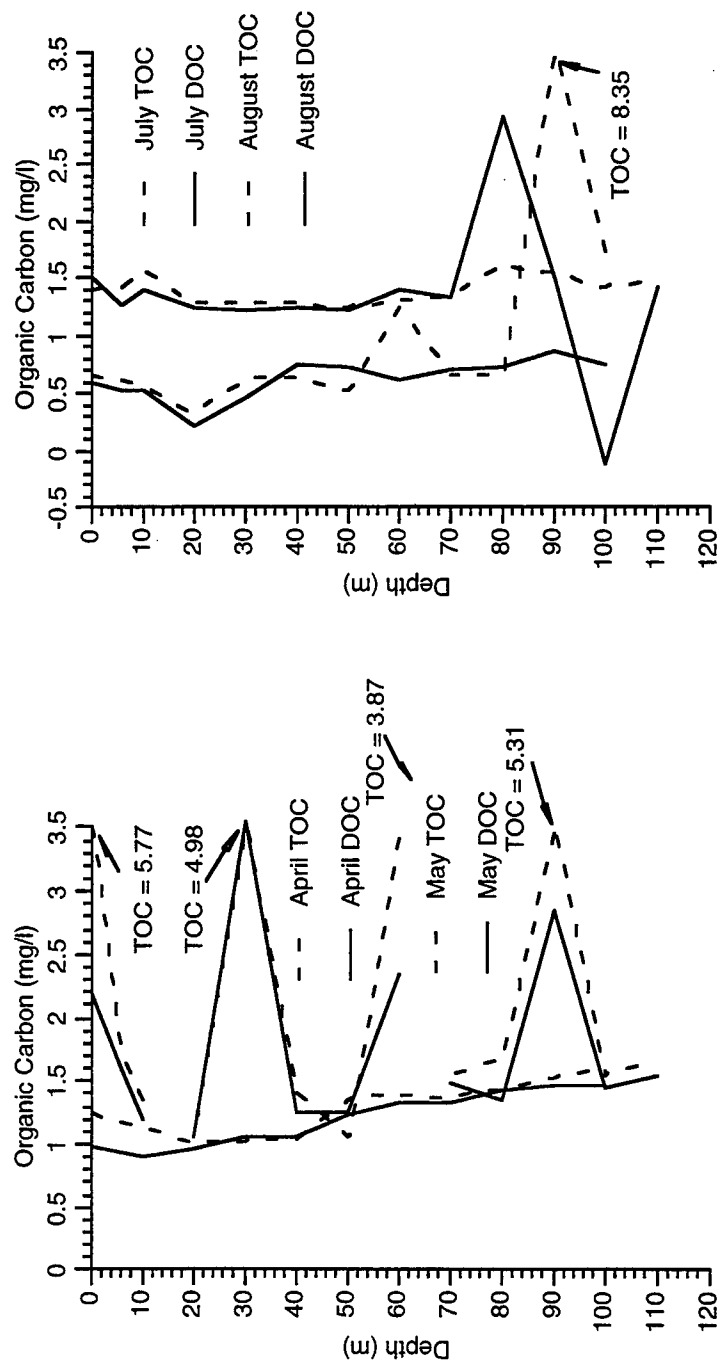


Figure 32. Organic carbon distributions in Cougar Lake in April - August 1996 showing that dissolved organic carbon is the greatest fraction of the total for most times, locations, and depths

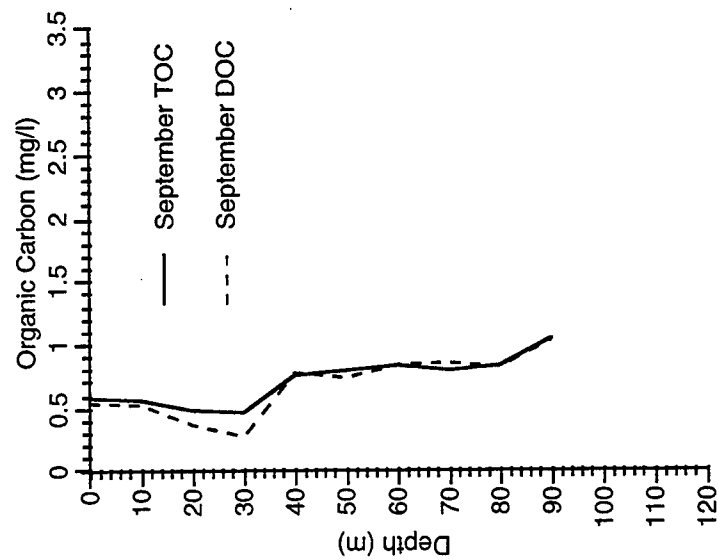


Figure 32. cont'd. Organic carbon distributions in Cougar Lake in September 1996 showing that dissolved organic carbon is the greatest fraction of the total for most times, locations, and depths

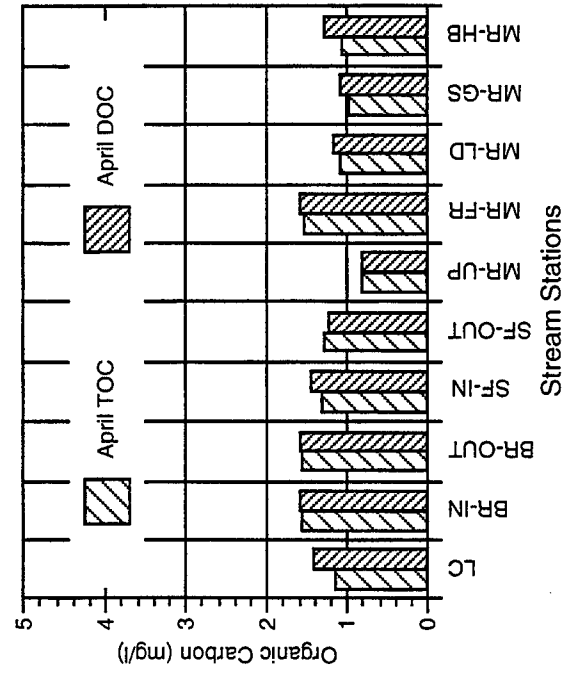
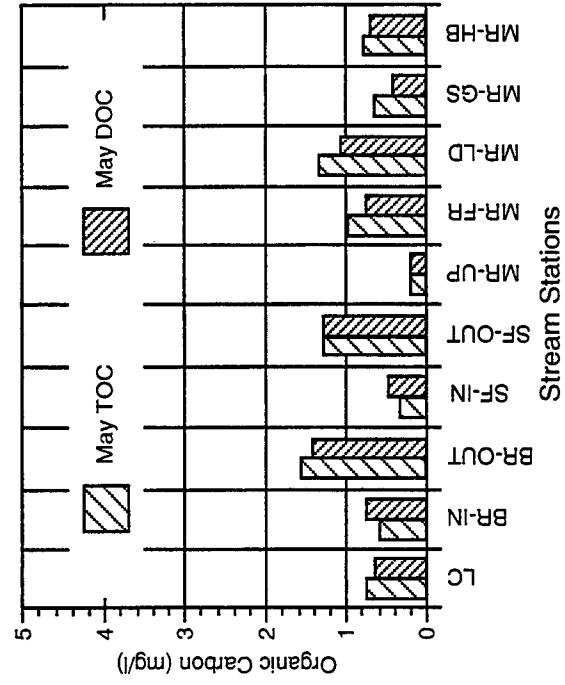


Figure 33. Organic carbon distributions in tributaries to and in the McKenzie River for the months April and May 1996. The dissolved fraction is usually the largest fraction of the total

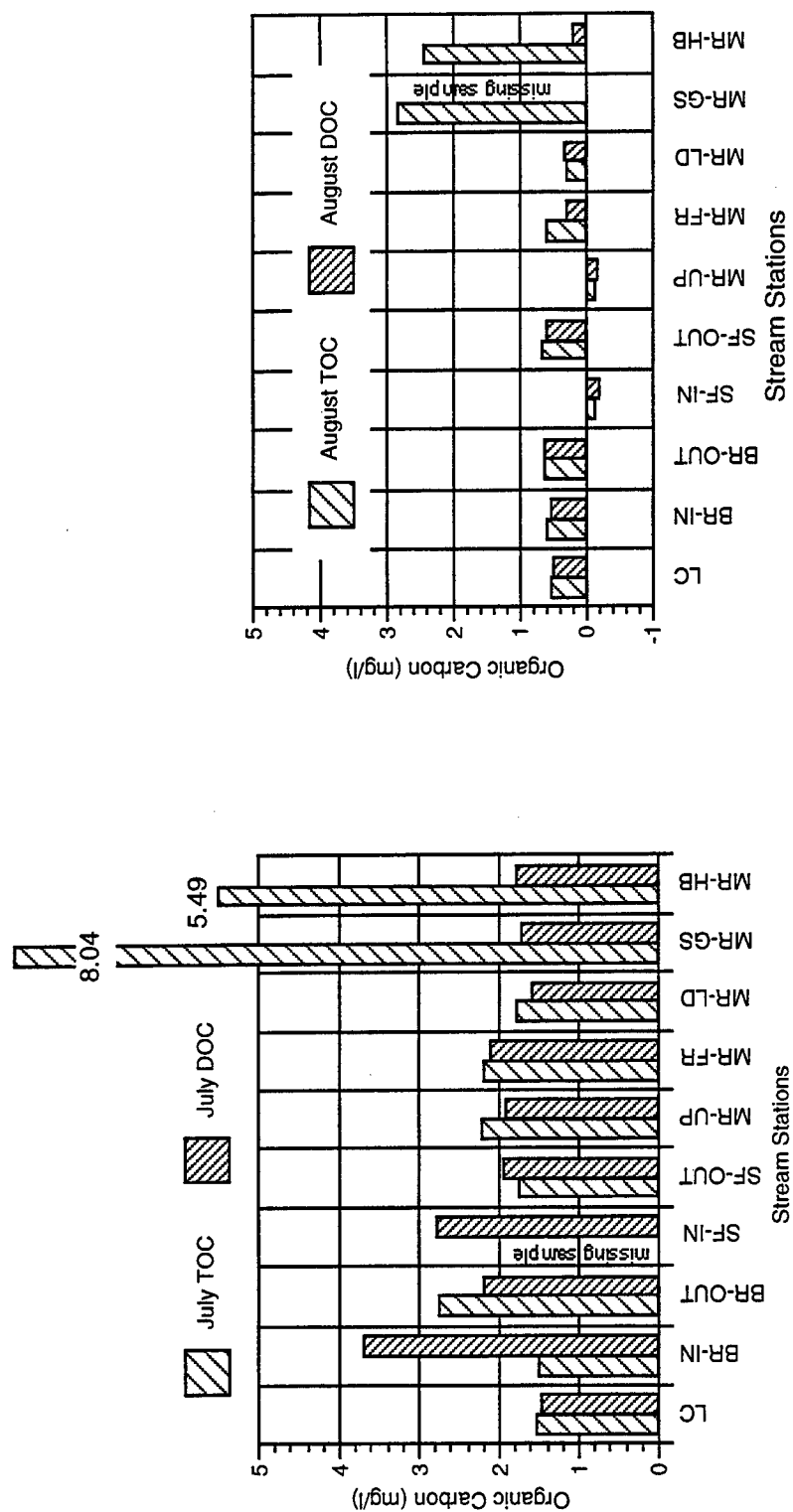


Figure 34. Organic carbon distributions in tributaries to and in the McKenzie River for the months July and August 1996. The dissolved fraction is usually the largest fraction of the total. July samples had greater concentrations of organic carbon than any other group of samples

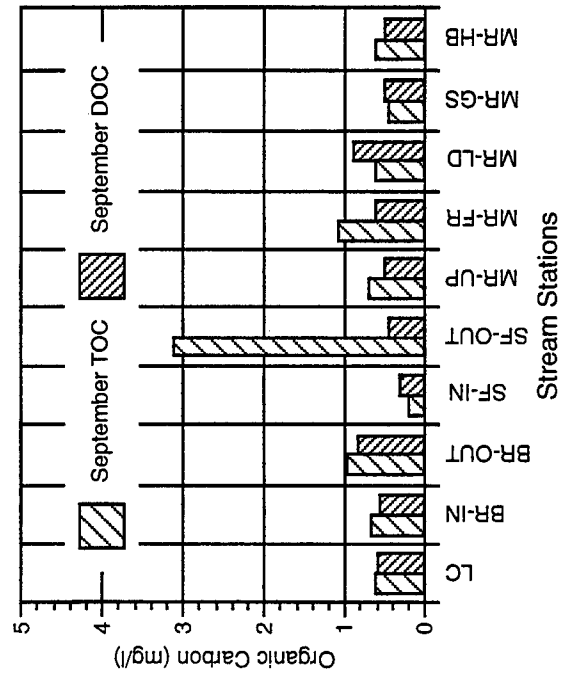


Figure 35. Organic carbon distributions in tributaries to and in the McKenzie River for September 1996.

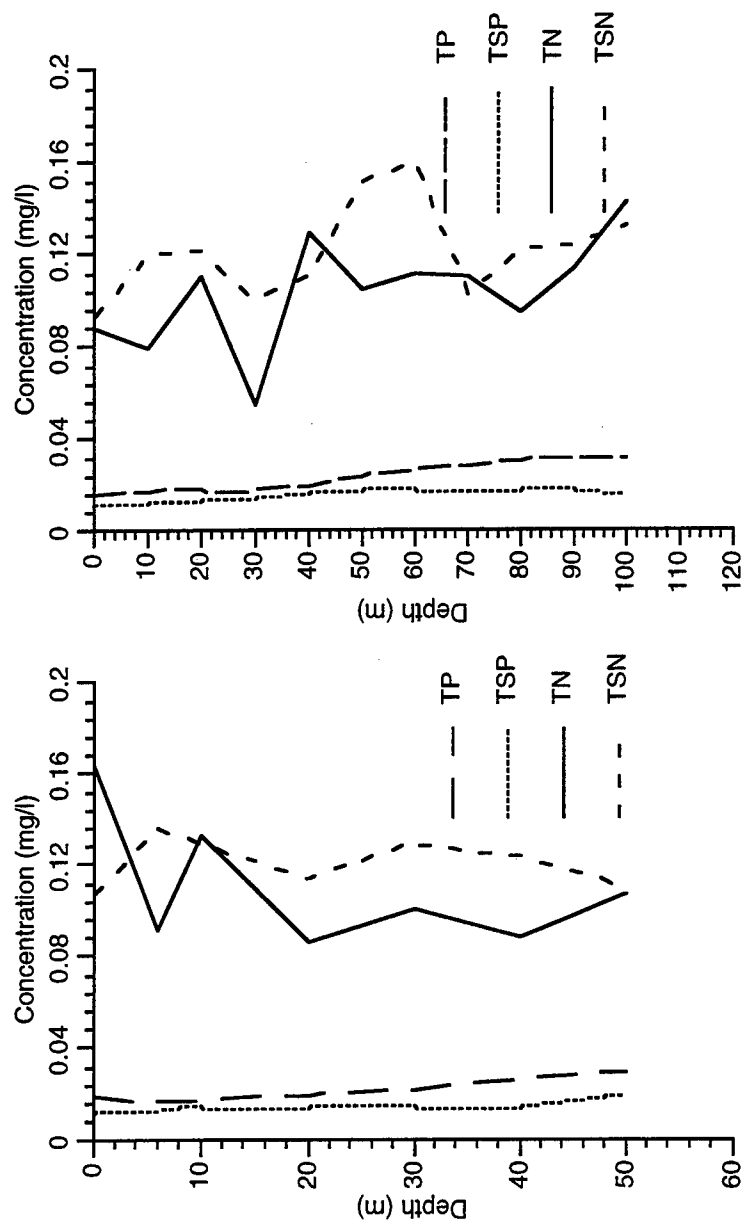


Figure 36. April 1996 concentrations of the nutrients total phosphorus (TP), total soluble phosphorus (TSP), total nitrogen (TN), and total soluble nitrogen (TSN) in Blue River and Cougar Lakes

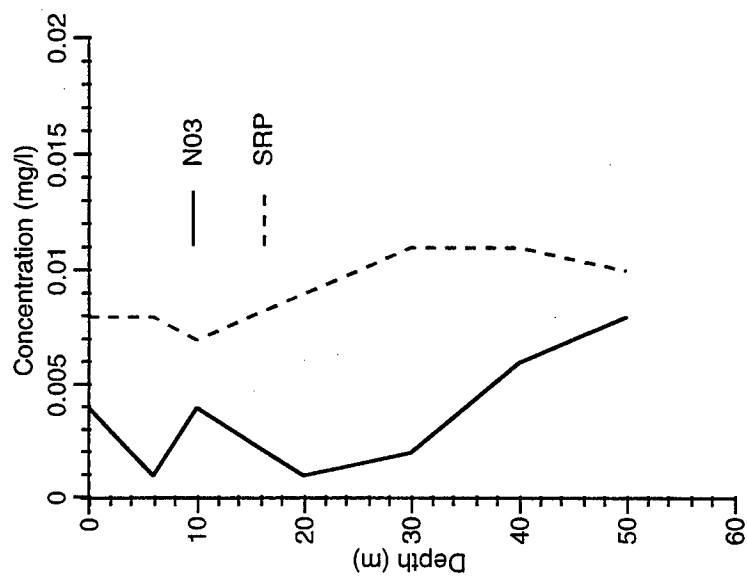
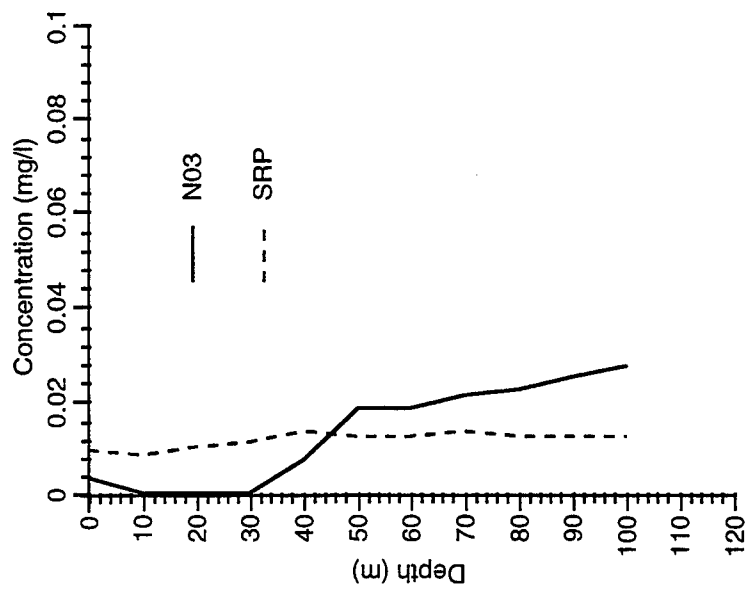


Figure 37. April 1996 concentrations of the nutrients nitrate (NO₃) and soluble reactive phosphorus (SRP) in Blue River and Cougar Lakes

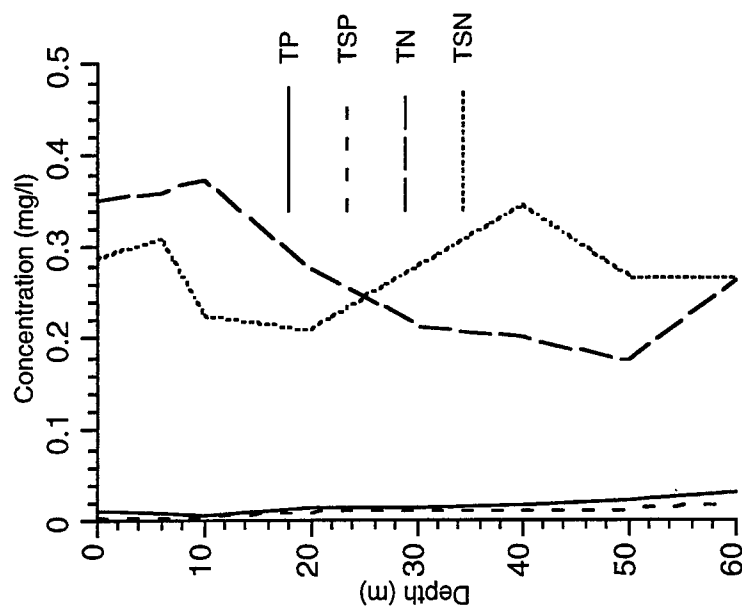
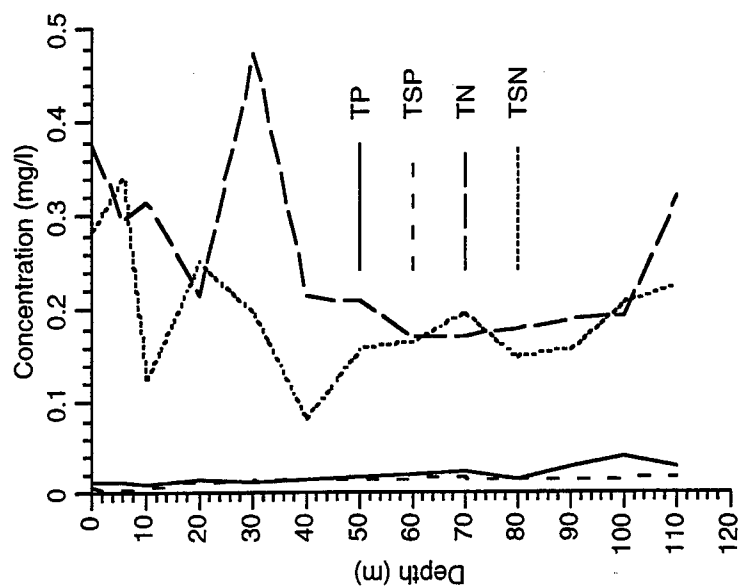


Figure 38. May 1996 concentrations of the nutrients; total phosphorus (TP), total soluble phosphorus (TSP), total nitrogen (TN), and total soluble nitrogen (TSN) in Blue River and Cougar Lakes

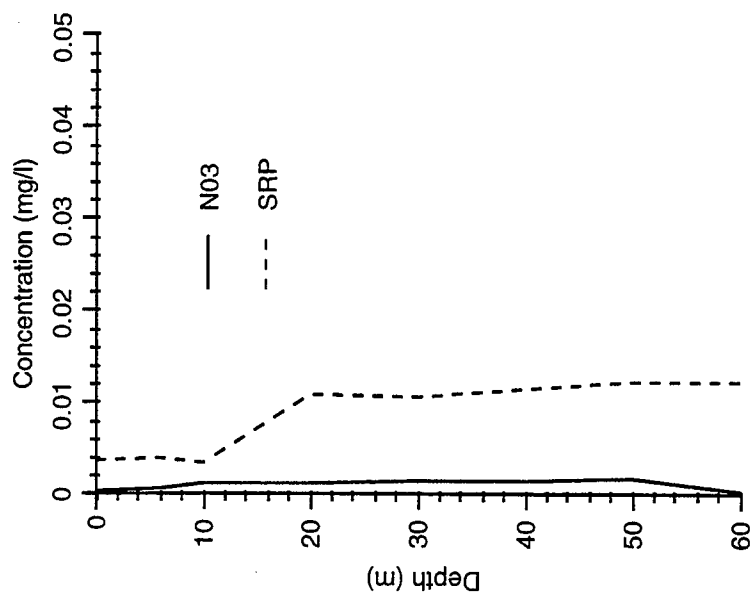
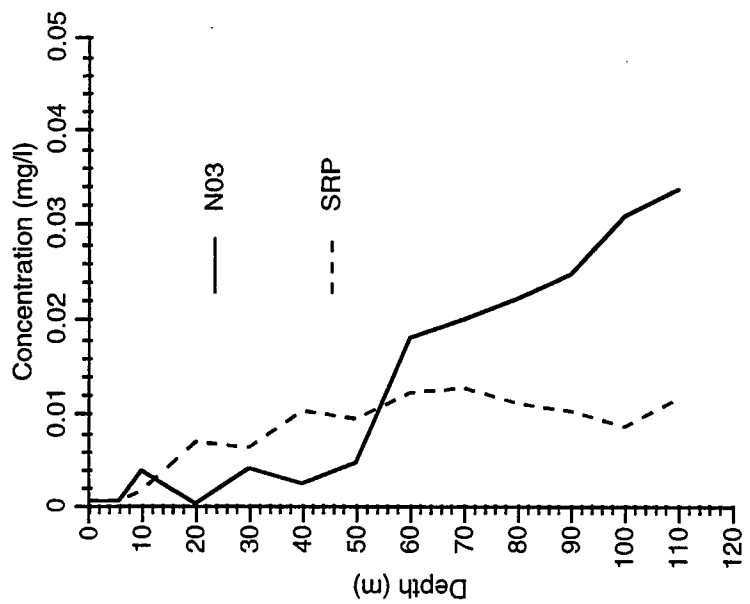


Figure 39. May 1996 concentrations of the nutrients nitrate (NO₃) and soluble reactive phosphorus (SRP) in Blue River and Cougar Lakes

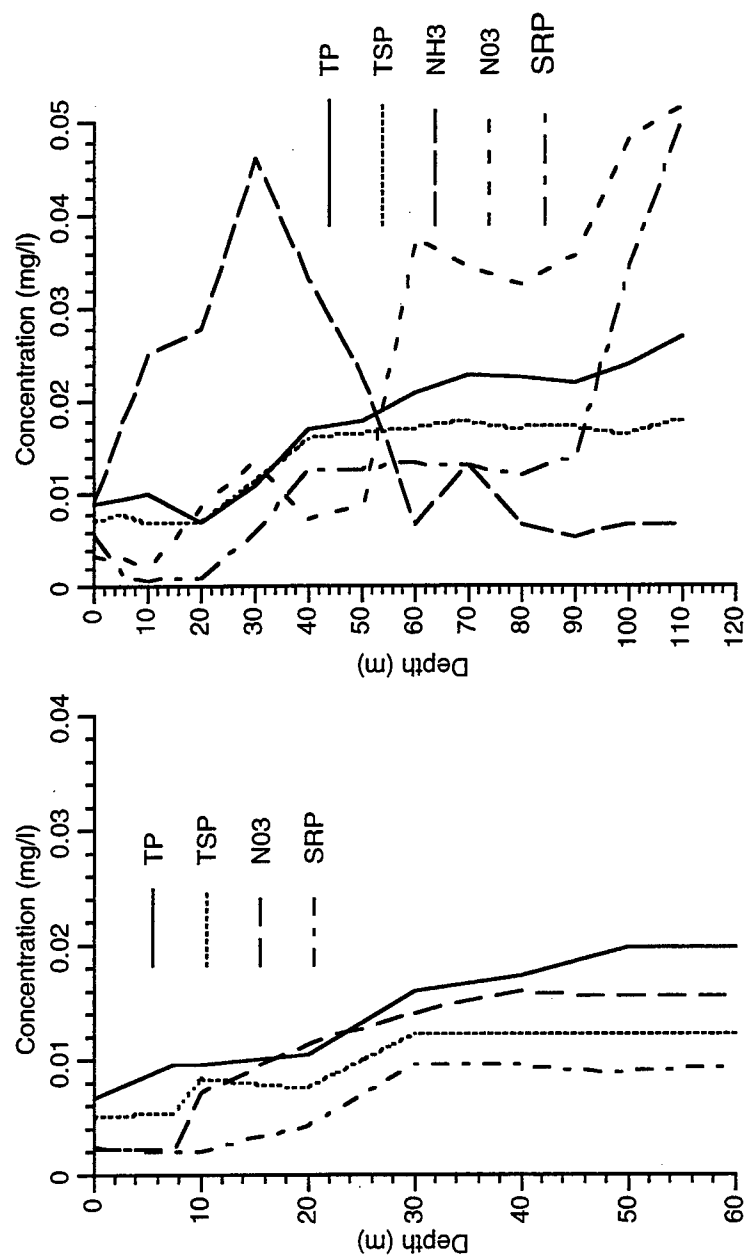


Figure 40. July 1996 concentrations of the nutrients total phosphorus (TP), total soluble phosphorus (TSP), soluble reactive phosphorus (SRP), ammonia (NH3), and nitrate (NO3) in Blue River and Cougar Lakes

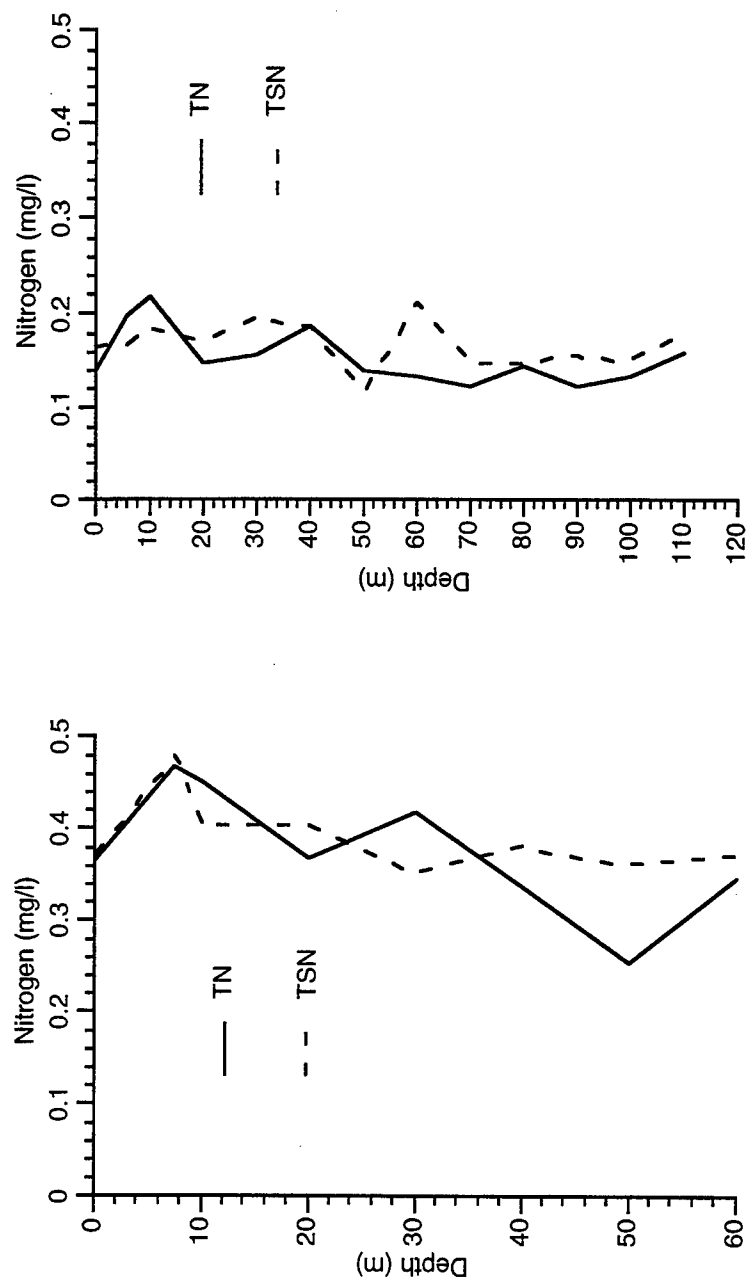


Figure 41. July 1996 concentrations of the nutrients; total nitrogen (TN) and total soluble nitrogen (TSN) in Blue River and Cougar Lakes

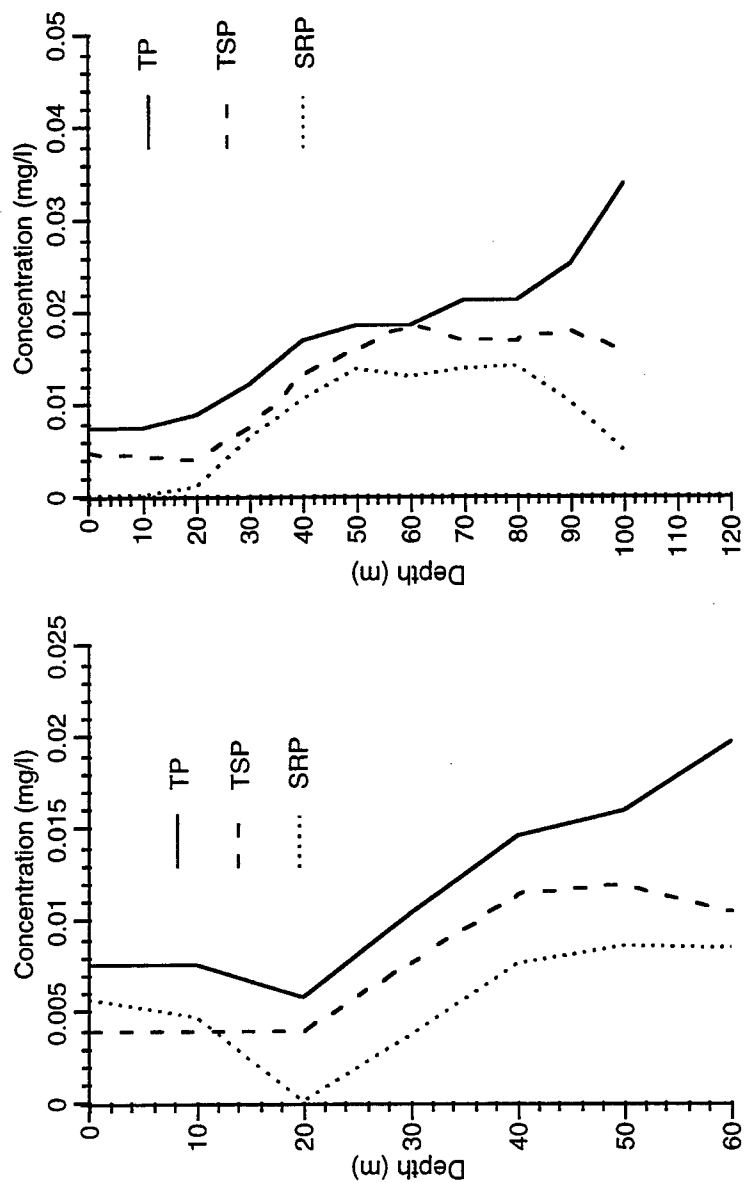


Figure 42. August 1996 concentrations of the nutrients total phosphorus (TP), total soluble phosphorus (TSP), and soluble reactive phosphorus (SRP) in Blue River and Cougar Lakes.

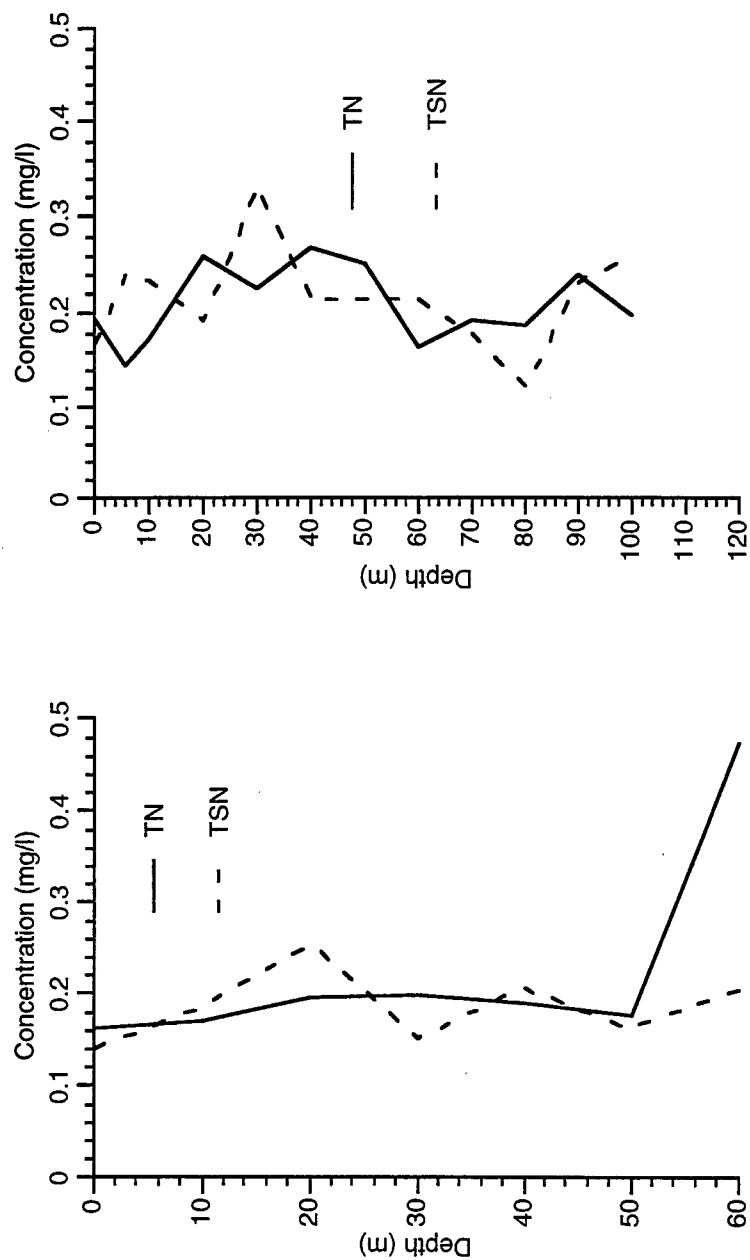


Figure 43. August 1996 concentrations of the nutrients total nitrogen (TN) and total soluble nitrogen (TSN) in Blue River and Cougar Lakes

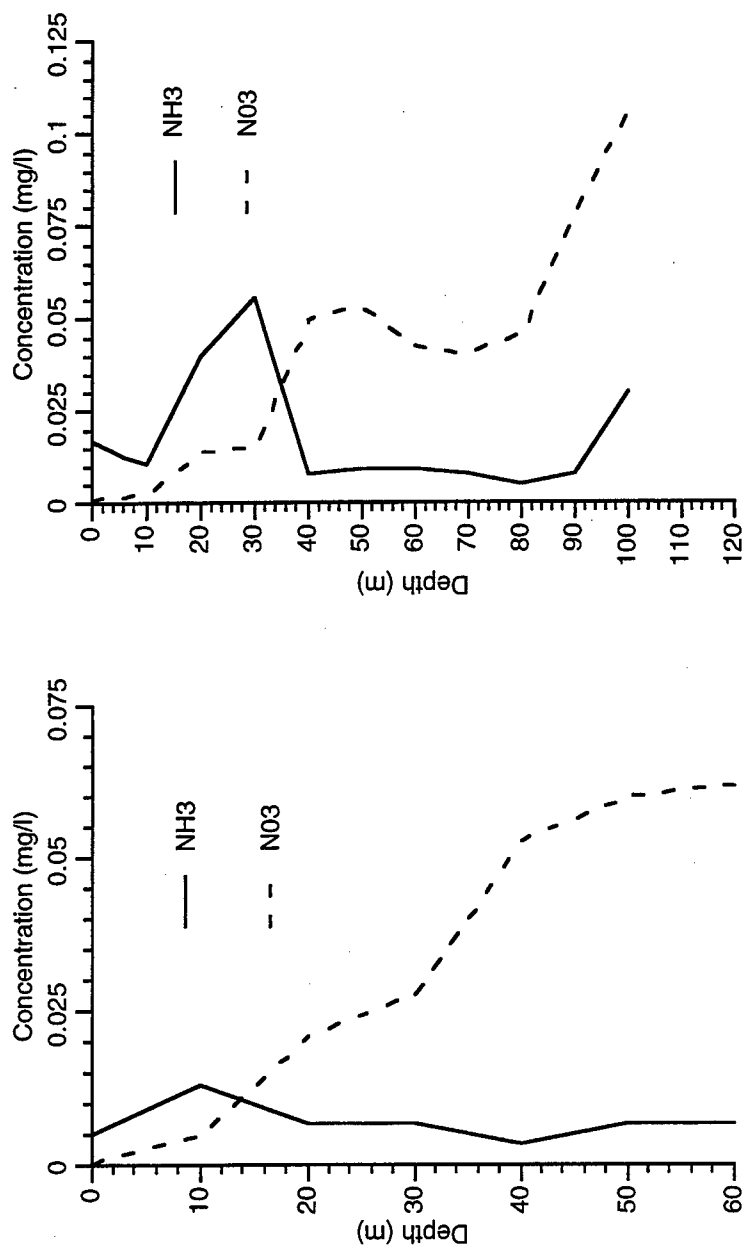


Figure 44. August 1996 concentrations of the nutrients ammonia (NH₃) and nitrate (NO₃) in Blue River and Cougar Lakes.

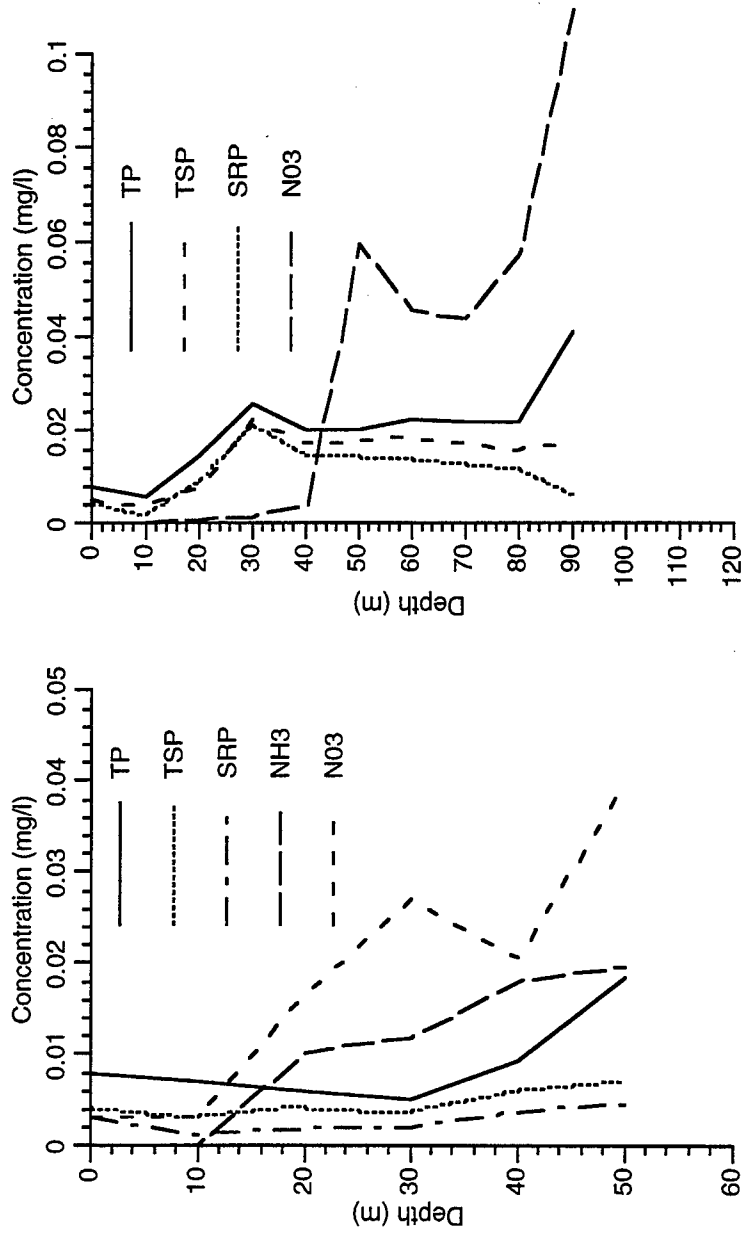


Figure 45. September 1996 concentrations of the nutrients total phosphorus (TP), total soluble phosphorus (TSP), soluble reactive phosphorus (SRP), ammonia (NH3), and nitrate (NO3) in Blue River and Cougar Lakes

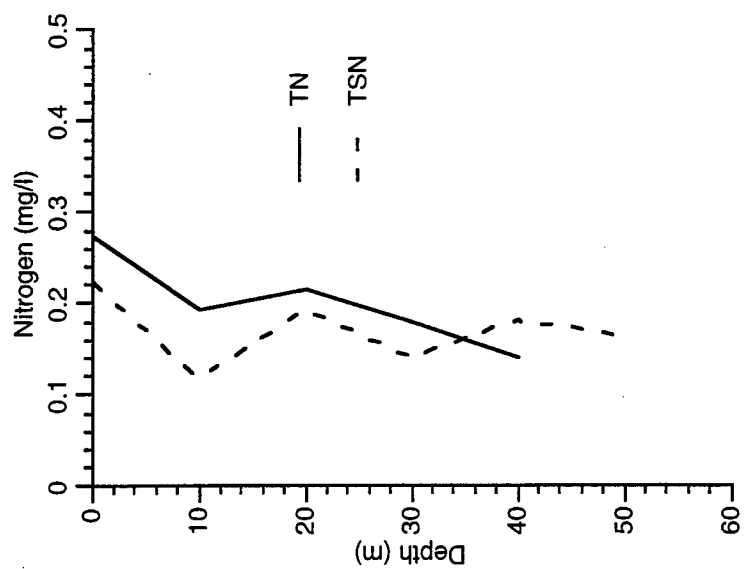
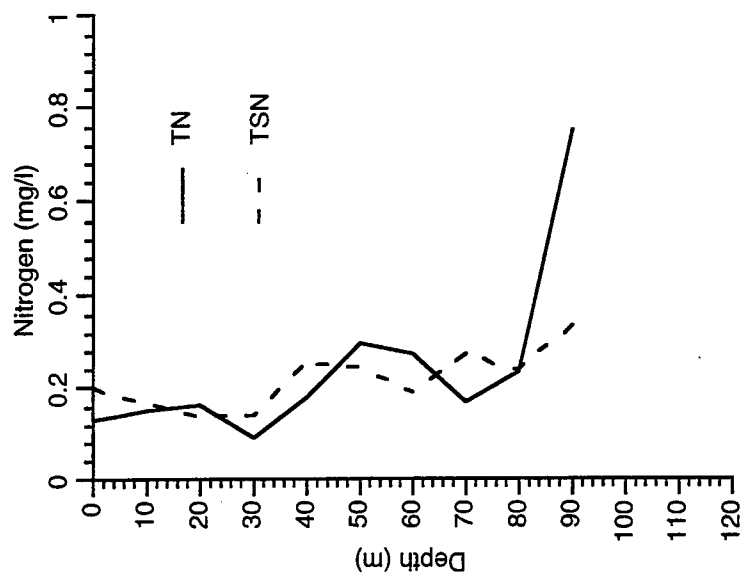


Figure 46. September 1996 concentrations of total nitrogen (TN) and total soluble nitrogen (TSN) in Blue River and Cougar Lakes

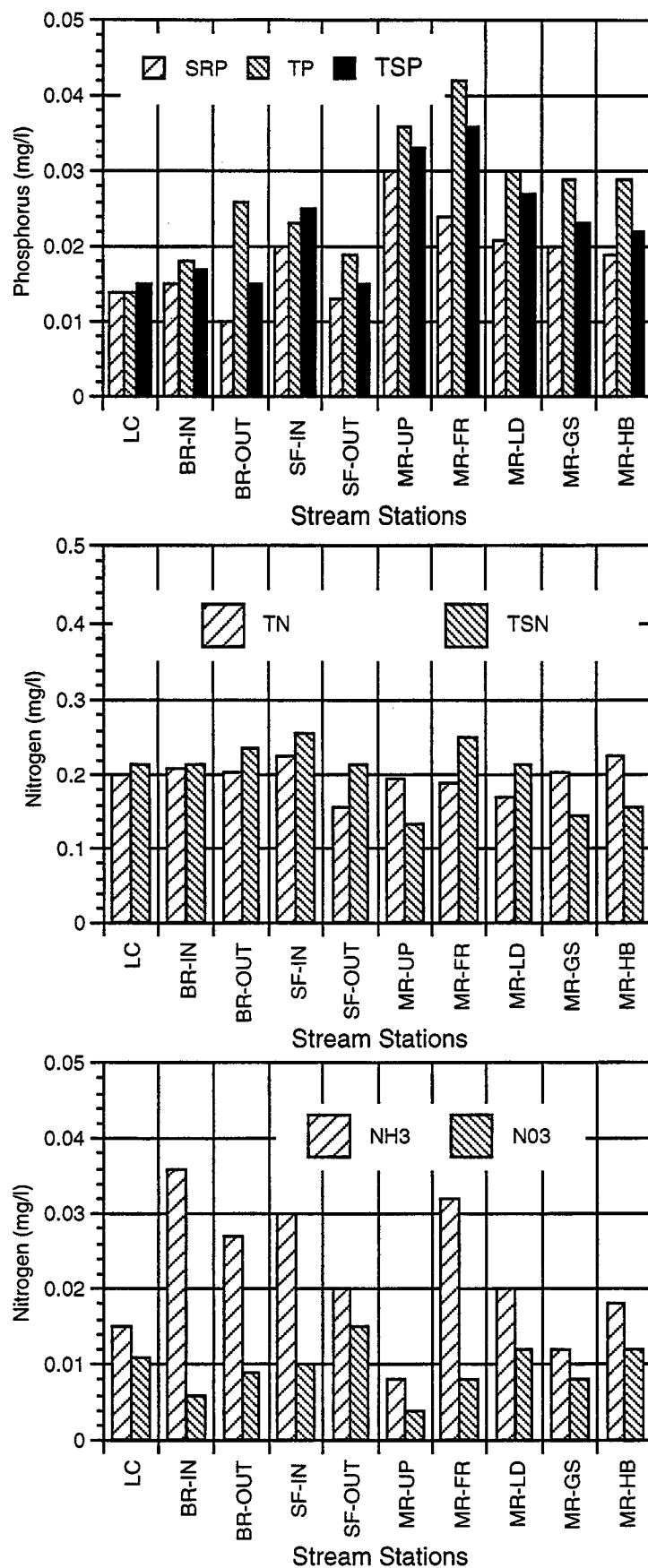


Figure 47. April 1996 chemical concentrations for inflows, outflows, and McKenzie River stations

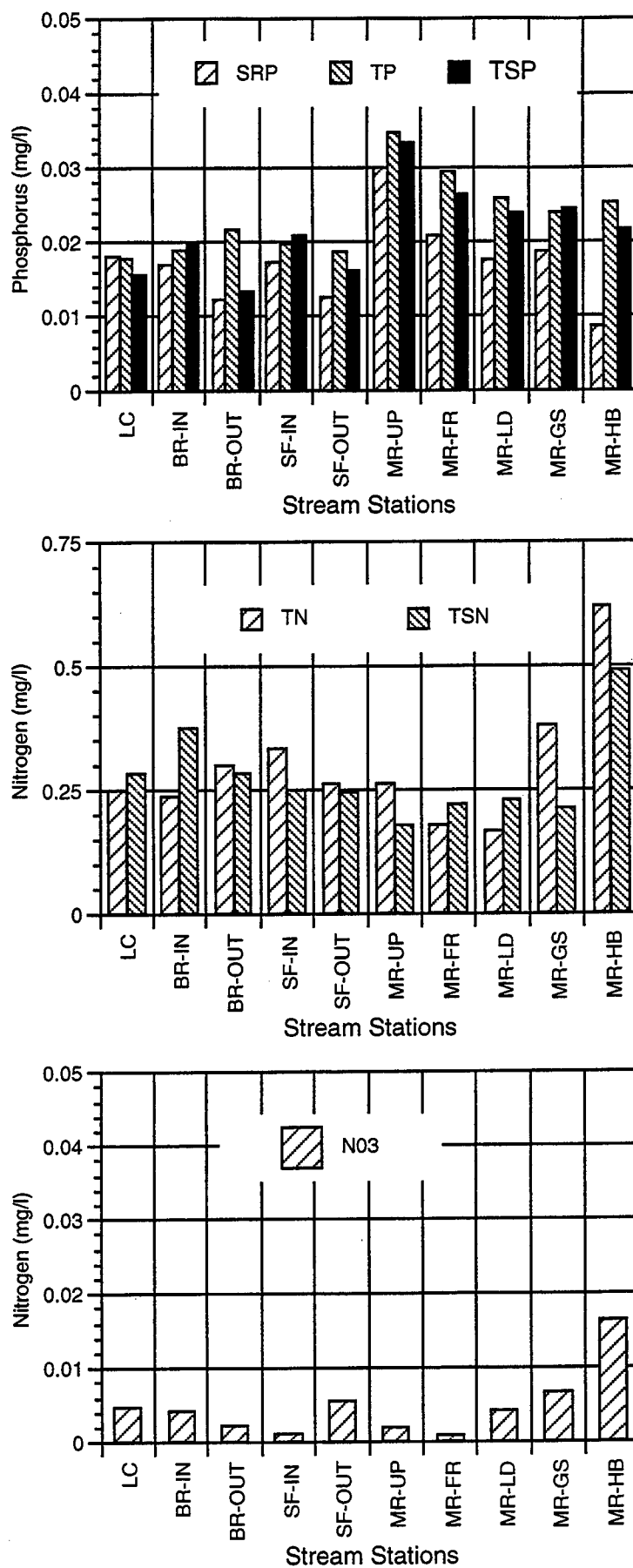


Figure 48. May 1996 chemical concentrations for inflows, outflows, and McKenzie River stations

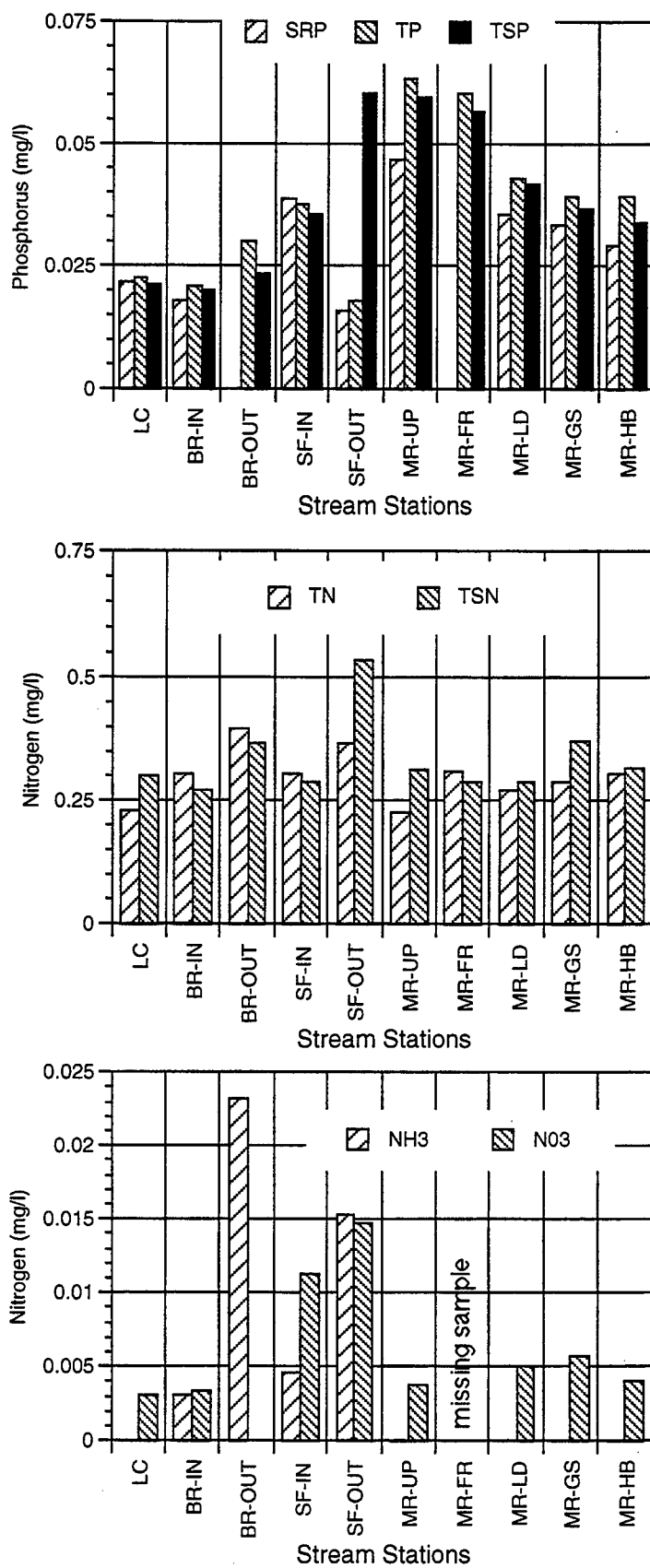


Figure 49. July 1996 chemical concentrations for inflows, outflows, and McKenzie River stations

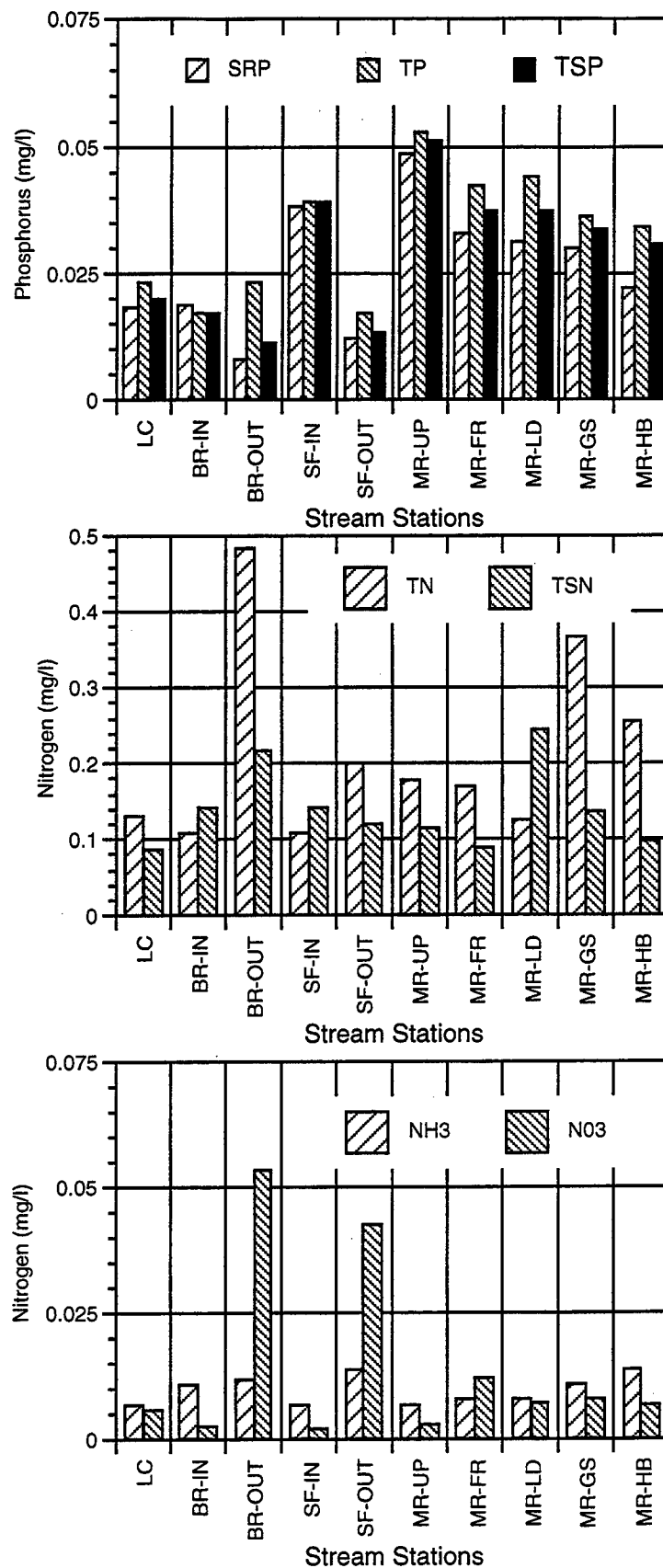


Figure 50. August 1996 chemical concentrations for inflows, outflows, and McKenzie River stations

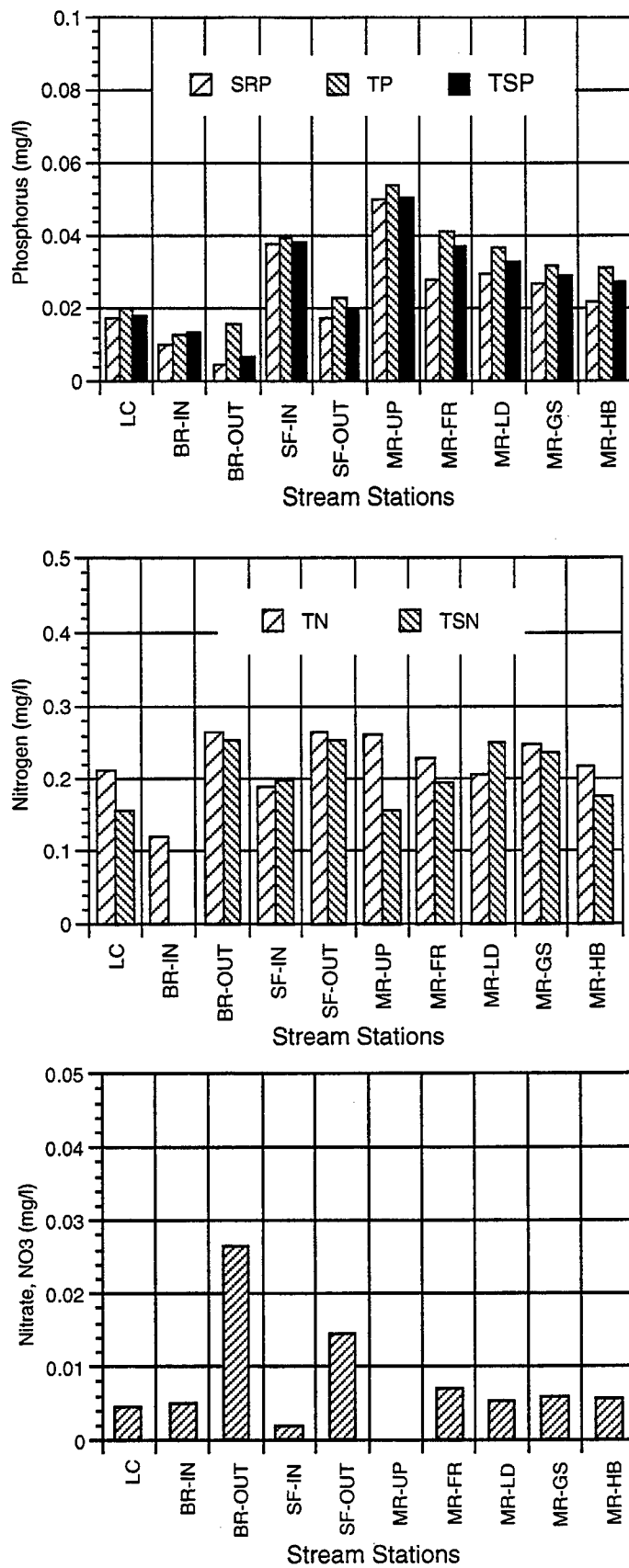


Figure 51. September 1996 chemical concentrations for inflows, outflows, and McKenzie River stations

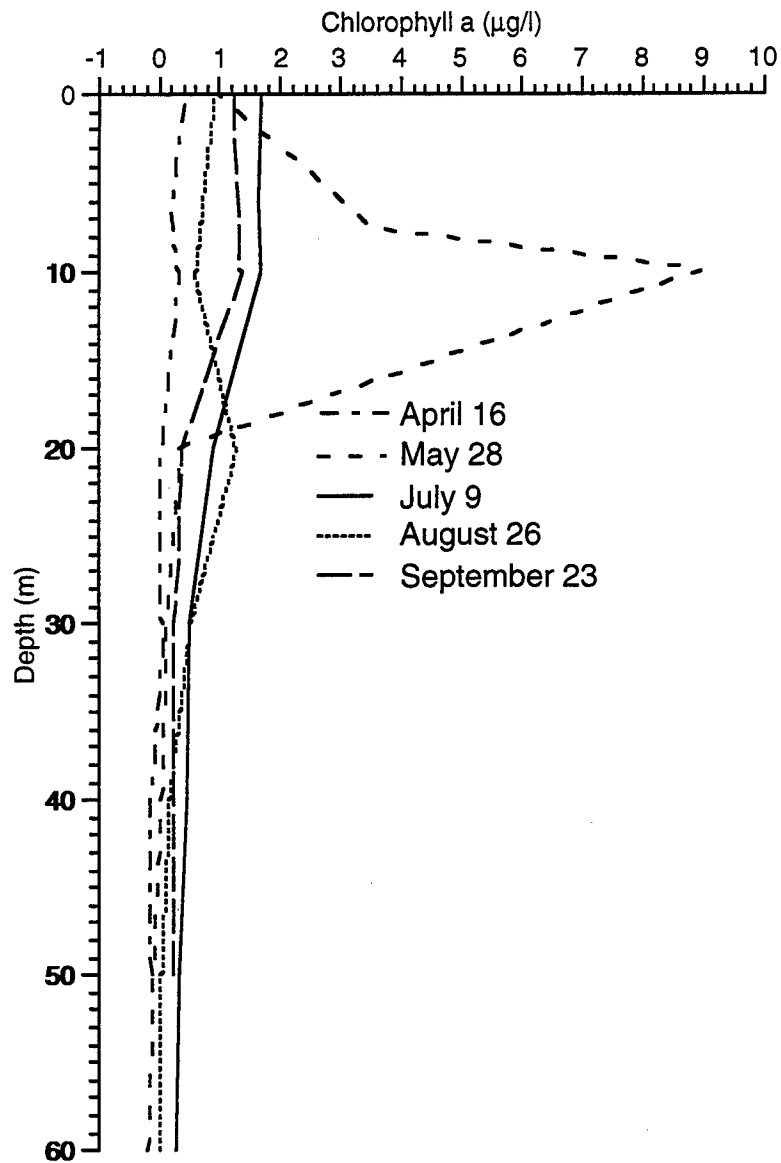


Figure52. Chlorophyll a concentrations (corrected for pheophytin) in Blue River Lake for 1996

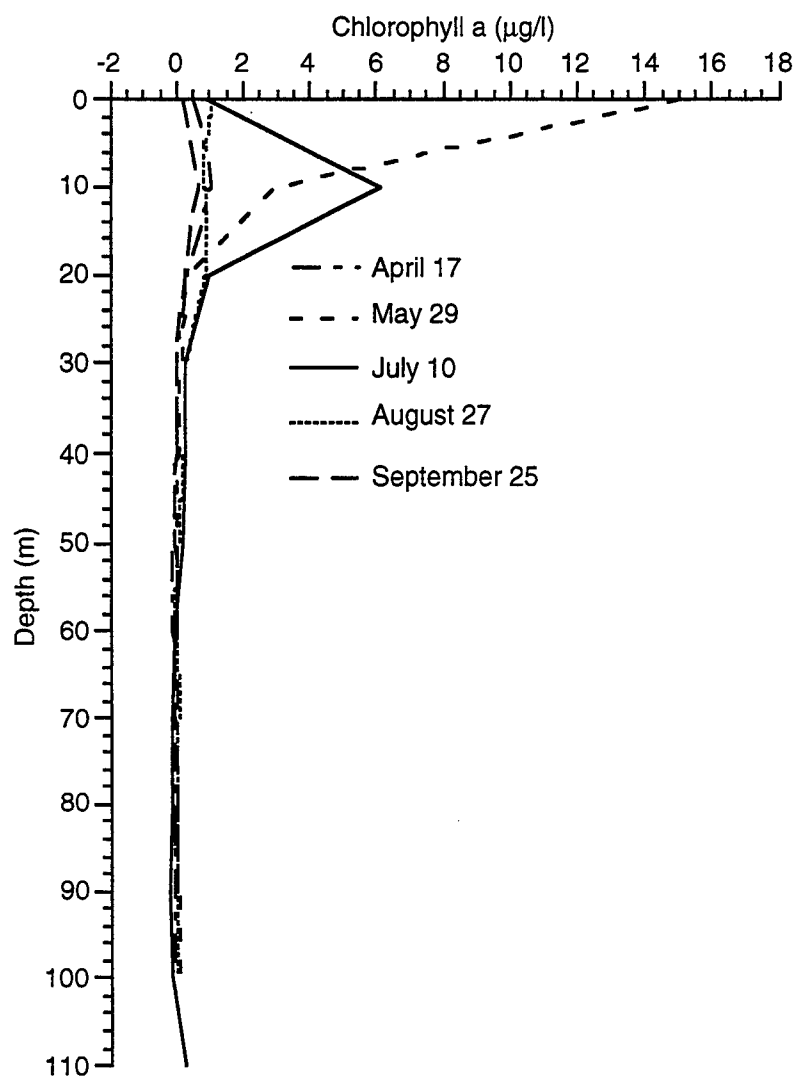


Figure53. Chlorophyll a concentrations (corrected for pheophytin) in Cougar Lake for 1996

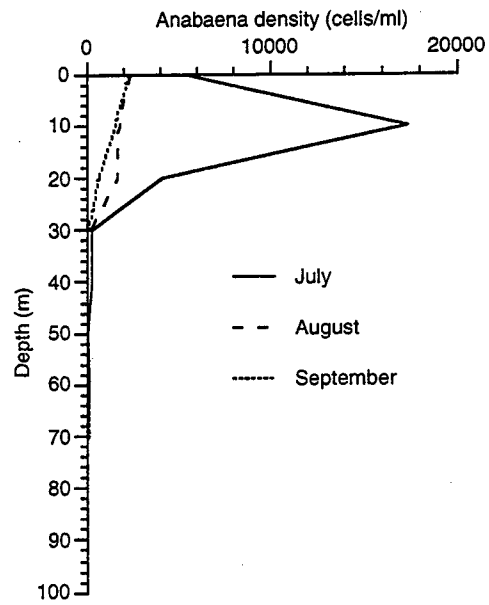
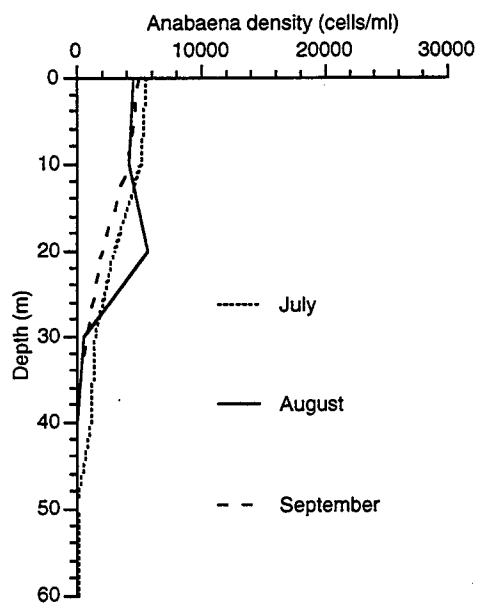
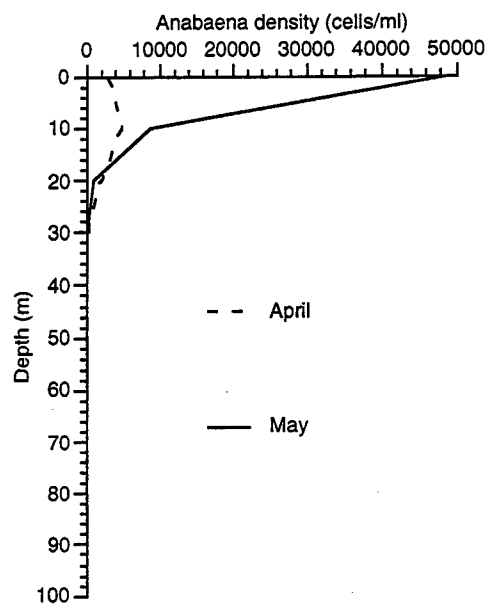
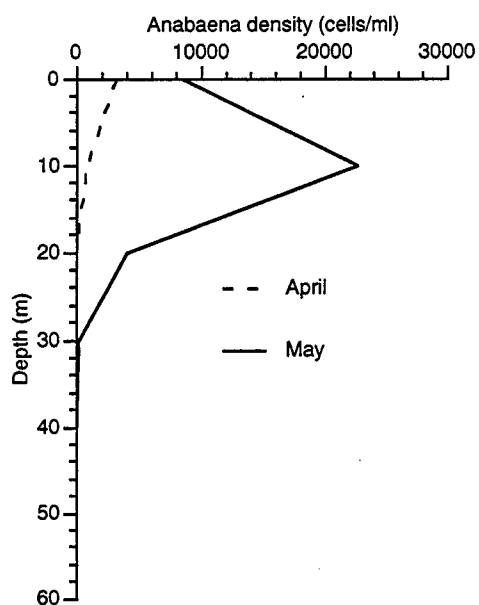


Figure 54. Population densities for *Anabaena* in Blue River and Cougar Lakes, 1996

TABLES

Table 1. Limnological characteristics of Cougar (CR) and Blue River (BR) Lakes

Characteristics	CR (1964)	Characteristics	BR (1968)
Maximum power pool elevation, m ngvd	517.9	Maximum pool elevation, m ngvd	413.6
Minimum power pool elevation, m ngvd	462.1	Minimum flood control pool, m ngvd	359.7
Flood control pool, m ngvd	467	Maximum conservation pool, m ngvd	411.5
Surface area, km ² , at max. power pool	518.4	Surface area, km ² , at max. power pool	395
Volume, m ³ (10 ⁶), at max. power pool	270.7	Volume, m ³ (10 ⁶), at max. power pool	110.5
Maximum depth, m, at max. power pool	120	Maximum depth, m, at max. power pool	70
Reservoir length, km, at max. power pool	10.5	Reservoir length, km, at max. power pool	10.3
Drainage area, km ²	544	Drainage area, km ²	278
Theoretical residence time, days at max. power pool	306	Theoretical residence time, days at max. power pool	102
Elevation, top of penstocks, m ngvd	181.4	Elevation, top of penstocks, m ngvd	133.2
Elevation, bottom of penstocks, m ngvd	160.9	Elevation, bottom of penstocks, m ngvd	110

Table 2. Descriptions of stream and lake locations of water quality sample. Each lake had four locations for in situ sampling and one for chemical sampling. All parameters were measured for each stream station

Station Description	Abbreviation	Location (lake, RM)
McKenzie River upstream from lakes, bridge on SF 19	MR-UP	RM 60
South Fork McKenzie River inflow to Cougar Lake	SF-IN	1 km above lake
Lookout Creek	LC	RM 0.5 above BR
Blue River inflow to Blue River Lake	BR-IN	RM 8.5
Cougar Dam outflow	SF-OUT	RM 4.5
Blue River Dam outflow	BR-OUT	RM 1.7
Finn Rock bridge	MR-FR	RM 54.2
Leaburg Dam outflow	MR-LD	RM 38.8
Gaging station downstream from Walterville canal	MR-GS	RM 27.7
Hayden Bridge water intake	MR-HB	
Cougar Lake sampling stations	CR1-4	Figure 2
Blue River Lake sampling stations	BR1-4	Figure 3

Table 3. Mean coefficient of variation of replicate and split samples

<u>Parameter</u>	<u>Replicate</u>	<u>Split</u>
Total phosphorous	5.68	2.54
Total dissolved phosphorous	12.11	1.81
Total nitrogen	7.28	8.38
Total dissolved nitrogen	10.86	9.84
Ammonia nitrogen	8.90	4.51
Nitrate nitrogen	8.45	1.11
Sulfate	0.85	1.06
Total organic carbon	3.94	2.06
Total dissolved organic carbon	3.50	2.50
Total manganese	13.95	3.03
Total dissolved manganese	7.37	0.58
Total iron	7.70	2.62
Total dissolved iron	7.73	2.43
Total alkalinity	2.16	1.67
Total suspended solids	26.95	28.19
Turbidity	7.90	5.75

Table 4. Mean percent recovery and standard deviation of spike and quality assurance (QA) samples

<u>Parameter</u>	<u>Spike</u>	<u>QA</u>
Total phosphorous	101.1±5.1	105.5±0.9
Total dissolved phosphorous	102.6±3.4	-
Soluble reactive phosphorous	95.2±5.0	104.2±3.4
Total nitrogen	112.2±27.8	-
Total dissolved nitrogen	95.4±28.8	-
Ammonia nitrogen	105.7±16.3	104.7±3.2
Nitrate nitrogen	96.9±4.6	101.2±3.6
Sulfate	99.6±5.1	-
Total organic carbon	106.0±9.9	96.6±6.7
Total dissolved organic carbon	106.3±17.3	-
Total manganese	100.9±4.4	-
Total dissolved manganese	103.0±2.3	100.8±2.2
Total iron	105.6±19.7	-
Total dissolved iron	99.4±3.5	93.4±8.6
Total alkalinity	88.5±7.2	96.5±1.2
Turbidity	104.7±17.1	-
Total suspended solids	-	99.2±3.5

Table 5. Phytopigment data for stream, inflow, and outflow stations, 1996. Note: negative numbers indicate likely zero concentrations. Concentrations expressed as μg pigment per liter ($\mu\text{g/l}$)

Station	Date	Depth	Chlorophyll a (corr)	Pheophytin	Chlorophyll a (tri)	Chlorophyll b	Chlorophyll c
BR-IN	Apr 18, 96	0	-0.147	-0.204	0.21	0.427	0.696
LC	Apr 18, 96	0	0.214	-0.454	0.014	-0.03	-0.052
SF	Apr 18, 96	0	0.147	-0.068	0.46	0.079	0.129
BR-OF	Apr 18, 96	0	-0.107	-0.136	0.158	0.054	0.246
CR-OF	Apr 18, 96	0	0.147	-0.113	0.194	0.037	0.241
MR-UP	Apr 18, 96	0	-0.067	0.159	0.426	0.067	0.215
MR-FR	Apr 18, 96	0	0.427	0.068	0.69	0.176	0.288
MR-GS	Apr 18, 96	0	0.441	0.182	0.849	0.107	0.323
MR-LD	Apr 18, 96	0	0.16	-0.091	0.359	0.284	0.563
MR-HB	Apr 18, 96	0	0.187	0.182	0.593	0.114	0.214
BR-IN	May 27, 96	0	0.254	-0.068	0.174	0.008	0.153
LC	May 27, 96	0	0.267	0.068	0.518	0.12	0.306
SF	May 27, 96	0	0.174	0	0.333	0.026	0.095
BR-OF	May 27, 96	0	0.214	0	0.482	0.13	0.372
CR-OF	May 27, 96	0	-0.107	0.023	0.239	-0.005	0.079
MR-UP	May 27, 96	0	-0.027	0.023	0.255	0.021	0.04
MR-FR	May 27, 96	0	0.027	-0.227	0.262	0	0.023
MR-LD	May 27, 96	0	0.174	-0.045	0.404	0.011	0.02
MR-GS	May 27, 96	0	0.12	-0.182	0.252	0.28	0.528
MR-HB	May 27, 96	0	0.334	0.159	0.597	0.067	0.184
BR-IN	Jul 8, 96	0	0.053	0.045	0.112	-0.12	-0.013
LC	Jul 8, 96	0	-0.067	0.113	0.054	-0.099	-0.038
SF	Jul 8, 96	0	-0.027	-0.25	0.09	-0.054	0.016
BR-OF	Jul 8, 96	0	-0.053	-0.182	0.159	-0.021	0.216
CR-OF	Jul 8, 96	0	0.267	-0.136	0.389	0.048	0.105
MR-UP	Jul 9, 96	0	0.067	-0.045	0.332	0.047	0.088
MR-FR	Jul 9, 96	0	0.067	0.159	0.386	0.087	0.114
MR-LD	Jul 9, 96	0	-0.147	0.295	-0.028	-0.065	-0.083
MR-GS	Jul 9, 96	0	0.307	0.272	0.568	0.02	0.117
MR-HB	Jul 9, 96	0	-0.214	0	0.141	0.012	0.08
BR-IN	Aug 28, 96	0	0.147	-0.454	0.136	-0.133	0.008
LC	Aug 28, 96	0	0	-0.113	0.08	-0.05	0.287
SF	Aug 28, 96	0	0.107	0.045	0.15	-0.003	0.352
BR-OF	Aug 28, 96	0	0.401	-0.091	0.363	-0.003	0.238
CR-OF	Aug 28, 96	0	0.227	-0.091	0.429	0.063	0.497
MR-UP	Aug 28, 96	0	0.36	-0.295	0.387	0.038	0.285
MR-FR	Aug 28, 96	0	0.334	-0.023	0.447	0.02	0.191
MR-LD	Aug 28, 96	0	0.427	-0.227	0.706	0.113	0.355
MR-GS	Aug 26, 96	0	0.481	0.113	0.559	0.022	0.307
MR-HB	Aug 26, 96	0	0.414	0	0.682	-0.057	0.146
BR-IN	Sep 26, 96	0	-0.147	-0.068	0.037	-0.182	-0.012
LC	Sep 26, 96	0	0	0.068	0.079	-0.144	0.089
SF	Sep 26, 96	0	0.053	-0.113	0.118	-0.125	0.011
BR-OF	Sep 26, 96	0	0.134	0.113	0.428	-0.036	0.254
CR-OF	Sep 26, 96	0	0.04	0.068	0.267	-0.057	-0.016
MR-UP	Sep 24, 96	0	0.401	0	0.469	-0.05	0.199
MR-FR	Sep 24, 96	0	0.481	-0.113	0.718	-0.021	0.191
MR-LD	Sep 24, 96	0	0.147	-0.091	0.582	-0.097	0.146
MR-GS	Sep 24, 96	0	0.347	0.136	0.556	-0.048	0.077
MR-HB	Sep 26, 96	0	0.134	-0.023	0.482	-0.178	-0.014

Table 6. Phytopigment data for Blue River Lake. Note: negative numbers indicate likely zero concentrations. Concentrations expressed as μg pigment per liter ($\mu\text{g/l}$)

Date	Depth	Chlorophyll a (corr)	Pheophytin	Chlorophyll a (tri)	Chlorophyll b	Chlorophyll c
Apr 16, 96	0	0.427	0.113	0.717	0.063	0.229
Apr 16, 96	6	0.174	0.113	0.481	0.081	0.286
Apr 16, 96	10	0.32	-0.204	0.344	0.081	0.259
Apr 16, 96	20	0.013	0.045	0.274	0.294	0.481
Apr 16, 96	30	0.053	-0.045	0.334	0.486	0.869
Apr 16, 96	40	-0.147	-0.204	0.21	0.427	0.696
Apr 16, 96	50	-0.107	-0.136	0.158	0.054	0.246
May 28, 96	0	1.669	0.113	1.843	-0.03	0.214
May 28, 96	6	1.615	-0.136	1.785	-0.096	0.175
May 28, 96	10	1.682	0.136	1.942	-0.073	0.257
May 28, 96	20	0.894	0.227	1.268	-0.04	0.118
May 28, 96	30	0.494	0.182	0.657	-0.017	0.068
May 28, 96	40	0.454	0.091	0.594	0.04	0.172
May 28, 96	50	0.32	-0.113	0.469	0.101	0.247
May 28, 96	60	0.267	0.068	0.518	0.12	0.306
Jul 9, 96	0	1.001	0.227	1.395	-0.065	0.158
Jul 9, 96	7.5	3.564	0.477	4.211	-0.215	0.367
Jul 9, 96	10	8.964	0.681	9.949	-0.656	1.037
Jul 9, 96	20	0.347	-0.068	0.557	0.087	0.083
Jul 9, 96	30	0.107	-0.159	0.203	0.018	0.117
Jul 9, 96	40	0.013	-0.113	0.145	0.024	0.133
Jul 9, 96	50	-0.107	-0.091	0.126	-0.012	0.012
Jul 9, 96	60	-0.214	0	0.141	0.012	0.08
Aug 26, 96	0	0.894	-0.227	1.05	0.035	0.205
Aug 26, 96	10	0.574	-0.045	0.89	-0.031	0.164
Aug 26, 96	20	1.308	0.068	1.722	0.028	0.382
Aug 26, 96	30	0.521	-0.068	0.61	-0.025	0.168
Aug 26, 96	40	0.147	0.068	0.217	-0.097	0.121
Aug 26, 96	50	0.013	-0.113	0.028	-0.14	-0.002
Aug 26, 96	60	0.04	0.068	0.176	0.076	0.056
Sep 23, 96	0	1.255	-0.045	1.398	0.029	0.261
Sep 23, 96	10	1.375	-0.091	1.604	-0.052	0.286
Sep 23, 96	20	0.387	0.091	0.619	0.006	0.2
Sep 23, 96	30	0.254	0.091	0.381	-0.065	0.01
Sep 23, 96	40	0.227	-0.182	0.297	-0.028	0.128
Sep 23, 96	50	0.254	-0.159	0.363	-0.06	0.131

Table 7. Phytopigment data for Cougar Lake. Note: negative numbers indicate likely zero concentrations.
Concentrations expressed as μg pigment per liter ($\mu\text{g/l}$)

Date	Depth (m)	Chlorophyll a (corr)	Pheophytin	Chlorophyll a (tri)	Chlorophyll b	Chlorophyll c
Apr 17, 96	0	0.481	0.045	0.693	0.091	0.168
Apr 17, 96	10	1.028	0.499	1.54	0.092	0.403
Apr 17, 96	20	0.32	-0.182	0.53	-0.011	0.118
Apr 17, 96	30	0.04	-0.023	0.183	-0.013	0.041
Apr 17, 96	40	0.053	-0.091	0.113	-0.009	0.12
Apr 17, 96	50	-0.08	0.136	0.087	0.046	0.096
Apr 17, 96	60	-0.12	0.159	0.158	0.249	0.417
Apr 17, 96	70	0	-0.023	0.152	0.186	0.397
Apr 17, 96	80	-0.04	0.023	0.073	0.126	0.222
Apr 17, 96	90	-0.093	-0.227	0.204	0.316	0.494
Apr 17, 96	100	-0.067	-0.182	0.297	0.467	0.759
May 29, 96	0	15.052	0.936	16.024	-0.657	1.332
May 29, 96	6	7.383	0.159	8.108	-0.005	0.869
May 29, 96	10	2.937	0.409	3.633	0.03	0.362
May 29, 96	20	0.294	0.023	0.445	-0.008	0.014
May 29, 96	30	0.134	-0.113	0.21	0.002	0.05
May 29, 96	40	0.067	-0.113	0.215	0.079	0.124
May 29, 96	50	0.027	-0.091	0.196	0.039	0.04
May 29, 96	60	0.027	0.136	0.21	0.105	0.351
May 29, 96	70	-0.027	-0.023	0.113	0.144	0.155
May 29, 96	80	-0.16	0.091	0.183	0.28	0.562
May 29, 96	90	0	0.068	0.212	0.227	0.385
May 29, 96	100	0.12	-0.182	0.252	0.28	0.528
Jul 10, 96	0	0.868	0.045	1.138	0.004	0.189
Jul 10, 96	10	6.101	0.613	6.812	-0.326	0.699
Jul 10, 96	20	0.961	0.477	1.568	-0.033	0.266
Jul 10, 96	30	0.227	0.068	0.494	0.02	0.082
Jul 10, 96	40	0.24	-0.204	0.358	0.005	0.096
Jul 10, 96	50	0.134	0.204	0.426	0.012	0.095
Jul 10, 96	60	-0.08	0	0.309	0.105	0.19
Jul 10, 96	70	-0.16	0.136	0.137	0.066	0.049
Jul 10, 96	80	-0.12	-0.068	0.268	0.107	0.261
Jul 10, 96	90	-0.187	-0.091	0.264	0.216	0.349
Jul 10, 96	100	-0.107	0.182	0.209	0.059	0.239
Jul 10, 96	110	0.28	-0.091	0.599	0.179	0.305
Aug 27, 96	0	1.108	-0.045	1.343	0.08	0.212
Aug 27, 96	6	0.881	-0.159	1.151	-0.013	0.203
Aug 27, 96	10	0.788	-0.091	0.924	0.105	0.289
Aug 27, 96	20	0.854	0.272	1.269	0.195	0.461
Aug 27, 96	30	0.307	0.113	0.72	0.019	0.269
Aug 27, 96	40	0.227	-0.272	0.263	-0.016	0.075
Aug 27, 96	50	0.093	-0.159	0.084	-0.063	0.033
Aug 27, 96	60	-0.027	0.136	0.02	-0.097	-0.086
Aug 27, 96	70	0.107	0.159	0.058	-0.023	0.049
Aug 27, 96	80	0.053	0.182	0.058	-0.021	0.025
Aug 27, 96	90	-0.013	0.045	0.06	-0.039	0.008
Aug 27, 96	100	0	0.068	0.124	0.011	0.074

Sep 25, 96	0	0.174	-0.023	0.359	-0.057	-0.057
Sep 25, 96	10	0.627	-0.113	0.675	-0.033	0.045
Sep 25, 96	20	0.227	0.159	0.486	-0.101	0.061
Sep 25, 96	30	0.013	-0.25	0.112	-0.103	-0.078
Sep 25, 96	40	0.027	-0.227	0.09	-0.071	0.081
Sep 25, 96	50	-0.053	0.113	0.015	-0.046	0.001
Sep 25, 96	60	-0.013	-0.34	0.021	-0.121	-0.054
Sep 25, 96	70	-0.067	-0.023	0.044	0.007	0.101
Sep 25, 96	80	-0.013	0.159	0.08	0.038	0.195
Sep 25, 96	90	0.013	-0.295	0.1	0.013	0.163

Table 8. Comparisons between measured and predicted SELECT release characteristics

Sample Date	Outflow temp. (°C)	SELECT temp. (°C)	Outflow D.O. (mg/l)	SELECT D.O. (mg/l)
May 29	7.3	7.31	11.8	11.18
July 10	9.0	8.67	11.0	10.27
July 23	NA	8.81	NA	9.54
August 27	9.3	9.57	9.8	9.44
September 25	12.5	10.15	9.1	9.11

Sample Date	Outflow temp. (°C)	SELECT temp. (°C)	Outflow TOC (mg/l)	SELECT TOC (mg/l)	Outflow DOC (mg/l)	SELECT DOC (mg/l)
May 29	7.3	7.31	1.27	2.35	1.27	1.75
July 10	9.0	8.67	1.75	NA	1.95	NA
July 23	NA	8.81	NA	1.34	NA	1.27
August 27	9.3	9.57	0.67	0.64	0.60	0.57
September 25	12.5	10.15	3.12	0.66	0.46	0.57

APPENDIX A

LIMNOLOGICAL FIELD DATA FOR BLUE RIVER AND COUGAR LAKES, AND THE MCKENZIE RIVER AND TRIBUTARIES

Appendix A1: Lake Data
Appendix A2: Stream Data

Cougar & Blue River insitu data

Month	Day	Year	time	Lake	Station	Secchi	Depth	CDepth	Temp	D. O.	pH	Cond.
4	16	96	1130	Blue River	1	3.2	0	52.3	11.3	12.5	7.1	26
4	16	96	1130	Blue River	1	3.2	2	52.3	11.4	12.5	7	27
4	16	96	1130	Blue River	1	3.2	4	52.3	11.2	12.5	7	27
4	16	96	1130	Blue River	1	3.2	6	52.3	9.7	12.9	7	28
4	16	96	1130	Blue River	1	3.2	8	52.3	8.8	12.8	7	28
4	16	96	1130	Blue River	1	3.2	10	52.3	8.2	12.7	6.9	28
4	16	96	1130	Blue River	1	3.2	12	52.3	7.6	12.6	6.9	28
4	16	96	1130	Blue River	1	3.2	14	52.3	7.3	12.7	6.9	28
4	16	96	1130	Blue River	1	3.2	16	52.3	7.1	12.7	6.8	26
4	16	96	1130	Blue River	1	3.2	18	52.3	7	12.8	6.8	25
4	16	96	1130	Blue River	1	3.2	20	52.3	6.8	12.9	6.8	28
4	16	96	1130	Blue River	1	3.2	22	52.3	6.7	12.9	6.8	27
4	16	96	1130	Blue River	1	3.2	24	52.3	6.6	12.9	6.8	26
4	16	96	1130	Blue River	1	3.2	26	52.3	6.5	12.9	6.8	27
4	16	96	1130	Blue River	1	3.2	28	52.3	6.4	12.9	6.8	25
4	16	96	1130	Blue River	1	3.2	30	52.3	6.2	12.8	6.8	25
4	16	96	1130	Blue River	1	3.2	32	52.3	6.1	12.8	6.7	25
4	16	96	1130	Blue River	1	3.2	34	52.3	6	12.8	6.7	24
4	16	96	1130	Blue River	1	3.2	36	52.3	5.9	12.7	6.7	24
4	16	96	1130	Blue River	1	3.2	38	52.3	5.9	12.7	6.7	25
4	16	96	1130	Blue River	1	3.2	40	52.3	5.9	12.8	6.7	25
4	16	96	1130	Blue River	1	3.2	42	52.3	5.7	12.6	6.6	24
4	16	96	1130	Blue River	1	3.2	44	52.3	5.7	12.5	6.6	26
4	16	96	1130	Blue River	1	3.2	46	52.3	5.6	12.6	6.6	24
4	16	96	1130	Blue River	1	3.2	48	52.3	5.6	12.6	6.5	24
4	16	96	1130	Blue River	1	3.2	50	52.3	5.6	12.6	6.5	25
4	16	96	1130	Blue River	1	3.2	52	52.3	5.5	12.6	6.5	24
4	16	96	1430	Blue River	2	2	0	38.2	11.4	12.5	7.2	26
4	16	96	1430	Blue River	2	2	2	38.2	11.3	12.4	7.2	26
4	16	96	1430	Blue River	2	2	4	38.2	11	12.5	7.1	26
4	16	96	1430	Blue River	2	2	6	38.2	9.7	12.7	7.1	26
4	16	96	1430	Blue River	2	2	8	38.2	8.9	12.7	7.1	26
4	16	96	1430	Blue River	2	2	10	38.2	8	12.9	7	26
4	16	96	1430	Blue River	2	2	12	38.2	7.9	12.9	7	26
4	16	96	1430	Blue River	2	2	14	38.2	7.5	12.9	7	26
4	16	96	1430	Blue River	2	2	16	38.2	7	13	7	27
4	16	96	1430	Blue River	2	2	18	38.2	6.9	13.1	6.9	27
4	16	96	1430	Blue River	2	2	20	38.2	6.7	13.1	6.9	27
4	16	96	1430	Blue River	2	2	22	38.2	6.6	13.1	6.9	27
4	16	96	1430	Blue River	2	2	24	38.2	6.4	13.1	6.9	25
4	16	96	1430	Blue River	2	2	26	38.2	6.2	13.1	6.9	26
4	16	96	1430	Blue River	2	2	28	38.2	6.1	13	6.8	26
4	16	96	1430	Blue River	2	2	30	38.2	6	13	6.8	25
4	16	96	1430	Blue River	2	2	32	38.2	5.8	13	6.8	26
4	16	96	1430	Blue River	2	2	34	38.2	5.8	12.9	6.7	25

Cougar & Blue River insitu data

4	16	96	1430	Blue River	2	2	36	38.2	5.7	12.8	6.7	25
4	16	96	1430	Blue River	2	2	38	38.2	5.7	12.7	6.9	25
4	16	96	1500	Blue River	3	2.2	0	33.2	11.3	12.4	7.2	26
4	16	96	1500	Blue River	3	2.2	2	33.2	11.3	12.4	7.2	26
4	16	96	1500	Blue River	3	2.2	4	33.2	10.4	12.5	7.1	26
4	16	96	1500	Blue River	3	2.2	6	33.2	9.3	12.7	7.1	25
4	16	96	1500	Blue River	3	2.2	8	33.2	8.8	12.8	7	26
4	16	96	1500	Blue River	3	2.2	10	33.2	8.1	12.9	7	26
4	16	96	1500	Blue River	3	2.2	12	33.2	7.6	12.9	7	26
4	16	96	1500	Blue River	3	2.2	14	33.2	7.4	13	7	25
4	16	96	1500	Blue River	3	2.2	16	33.2	7.1	13.1	7	25
4	16	96	1500	Blue River	3	2.2	18	33.2	6.8	13.1	6.9	28
4	16	96	1500	Blue River	3	2.2	20	33.2	6.6	13.1	6.9	25
4	16	96	1500	Blue River	3	2.2	22	33.2	6.5	13.1	6.9	25
4	16	96	1500	Blue River	3	2.2	24	33.2	6.3	13.1	6.9	26
4	16	96	1500	Blue River	3	2.2	26	33.2	6.2	13	6.9	26
4	16	96	1500	Blue River	3	2.2	28	33.2	6.1	12.9	6.8	25
4	16	96	1500	Blue River	3	2.2	30	33.2	6	12.8	6.8	26
4	16	96	1500	Blue River	3	2.2	32	33.2	5.9	12.6	6.8	26
4	16	96	1500	Blue River	3	2.2	32.7	33.2	5.9	12.5	6.7	28
4	16	96	1525	Blue River	4	2.2	0	21.1	11	12.7	7.2	26
4	16	96	1525	Blue River	4	2.2	2	21.1	11	12.6	7	26
4	16	96	1525	Blue River	4	2.2	4	21.1	10.7	12.6	7	26
4	16	96	1525	Blue River	4	2.2	6	21.1	10.4	12.6	7	26
4	16	96	1525	Blue River	4	2.2	8	21.1	8.6	12.9	7	25
4	16	96	1525	Blue River	4	2.2	10	21.1	8.1	12.9	7	26
4	16	96	1525	Blue River	4	2.2	12	21.1	7.8	12.9	7	26
4	16	96	1525	Blue River	4	2.2	14	21.1	7.5	13	7	27
4	16	96	1525	Blue River	4	2.2	16	21.1	7.4	13.1	7	27
4	16	96	1525	Blue River	4	2.2	18	21.1	7	13.1	7	26
4	16	96	1525	Blue River	4	2.2	20	21.1	6.9	13.2	7	26
4	16	96	1525	Blue River	4	2.2	20.6	21.1	6.7	13.1	6.9	26
5	28	96	1107	Blue River	01	2.9	0	66.2	14.1	11.1	8.5	26
5	28	96	1107	Blue River	01	2.9	2	66.2	13.8	11.2	8.4	26
5	28	96	1107	Blue River	01	2.9	4	66.2	13.1	11.5	8.3	26
5	28	96	1107	Blue River	01	2.9	6	66.2	11.6	11.5	8.0	26
5	28	96	1107	Blue River	01	2.9	8	66.2	11.0	11.2	7.8	25
5	28	96	1107	Blue River	01	2.9	10	66.2	10.5	11.0	7.6	25
5	28	96	1107	Blue River	01	2.9	12	66.2	10.1	11.0	7.5	25
5	28	96	1107	Blue River	01	2.9	14	66.2	9.8	10.9	7.4	24
5	28	96	1107	Blue River	01	2.9	16	66.2	9.5	10.9	7.3	25
5	28	96	1107	Blue River	01	2.9	18	66.2	9.3	11.0	7.3	25
5	28	96	1107	Blue River	01	2.9	20	66.2	9.1	11.0	7.2	24
5	28	96	1107	Blue River	01	2.9	22	66.2	8.8	11.0	7.2	23
5	28	96	1107	Blue River	01	2.9	24	66.2	8.7	10.8	7.1	24
5	28	96	1107	Blue River	01	2.9	26	66.2	8.5	10.8	7.1	24

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5	28	96	1107	Blue River	01	2.9	28	66.2	8.4	10.8	7.0	23
5	28	96	1107	Blue River	01	2.9	30	66.2	8.4	10.7	7.0	24
5	28	96	1107	Blue River	01	2.9	32	66.2	8.3	10.8	7.0	23
5	28	96	1107	Blue River	01	2.9	34	66.2	8.2	10.7	7.0	24
5	28	96	1107	Blue River	01	2.9	36	66.2	8.1	10.7	6.9	23
5	28	96	1107	Blue River	01	2.9	38	66.2	8.1	10.8	6.9	23
5	28	96	1107	Blue River	01	2.9	40	66.2	8.1	10.9	6.9	23
5	28	96	1107	Blue River	01	2.9	42	66.2	8.0	10.9	6.8	24
5	28	96	1107	Blue River	01	2.9	44	66.2	8.0	10.9	6.8	23
5	28	96	1107	Blue River	01	2.9	46	66.2	7.9	11.0	6.8	23
5	28	96	1107	Blue River	01	2.9	48	66.2	7.9	11.0	6.8	22
5	28	96	1107	Blue River	01	2.9	50	66.2	7.8	11.0	6.7	23
5	28	96	1107	Blue River	01	2.9	52	66.2	7.8	11.0	6.7	22
5	28	96	1107	Blue River	01	2.9	54	66.2	7.8	11.0	6.7	22
5	28	96	1107	Blue River	01	2.9	56	66.2	7.7	10.9	6.7	24
5	28	96	1107	Blue River	01	2.9	58	66.2	7.6	10.9	6.7	24
5	28	96	1107	Blue River	01	2.9	60	66.2	7.6	10.8	6.6	23
5	28	96	1107	Blue River	01	2.9	62	66.2	7.6	10.8	6.6	23
5	28	96	1107	Blue River	01	2.9	64	66.2	7.6	10.7	6.6	23
5	28	96	1107	Blue River	01	2.9	66	66.2	7.6	10.7	6.6	22
5	28	96	1445	Blue River	02	2.7	0	41.1	14.8	11.5	8.1	26
5	28	96	1445	Blue River	02	2.7	2	41.1	14.6	11.4	8.1	26
5	28	96	1445	Blue River	02	2.7	4	41.1	14.2	11.5	8.2	25
5	28	96	1445	Blue River	02	2.7	6	41.1	11.4	11.6	8.0	25
5	28	96	1445	Blue River	02	2.7	8	41.1	10.8	11.5	7.8	25
5	28	96	1445	Blue River	02	2.7	10	41.1	10.3	11.4	7.6	25
5	28	96	1445	Blue River	02	2.7	12	41.1	9.8	11.4	7.5	24
5	28	96	1445	Blue River	02	2.7	14	41.1	9.6	11.4	7.5	24
5	28	96	1445	Blue River	02	2.7	16	41.1	9.4	11.4	7.4	24
5	28	96	1445	Blue River	02	2.7	18	41.1	9.2	11.4	7.4	25
5	28	96	1445	Blue River	02	2.7	20	41.1	9.1	11.4	7.3	24
5	28	96	1445	Blue River	02	2.7	22	41.1	8.9	11.6	7.3	24
5	28	96	1445	Blue River	02	2.7	24	41.1	8.8	11.6	7.3	25
5	28	96	1445	Blue River	02	2.7	26	41.1	8.7	11.6	7.2	24
5	28	96	1445	Blue River	02	2.7	28	41.1	8.6	11.6	7.2	23
5	28	96	1445	Blue River	02	2.7	30	41.1	8.5	11.6	7.2	24
5	28	96	1445	Blue River	02	2.7	32	41.1	8.4	11.5	7.1	24
5	28	96	1445	Blue River	02	2.7	34	41.1	8.3	11.4	7.1	24
5	28	96	1445	Blue River	02	2.7	36	41.1	8.2	11.3	7.1	24
5	28	96	1445	Blue River	02	2.7	38	41.1	8.1	11.2	7.1	23
5	28	96	1445	Blue River	02	2.7	40	41.1	7.9	11.1	7.0	24
5	28	96	1637	Blue River	03	2.8	0	40.5	15.1	11.3	8.4	26
5	28	96	1637	Blue River	03	2.8	2	40.5	15.0	11.2	8.3	26
5	28	96	1637	Blue River	03	2.8	4	40.5	14.5	11.3	8.4	25
5	28	96	1637	Blue River	03	2.8	6	40.5	12.2	11.3	8.2	26
5	28	96	1637	Blue River	03	2.8	8	40.5	11.2	11.4	8.0	24

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5	28	96	1637	Blue River	03	2.8	10	40.5	10.4	11.4	7.8	25
5	28	96	1637	Blue River	03	2.8	12	40.5	10.1	11.5	7.7	25
5	28	96	1637	Blue River	03	2.8	14	40.5	9.7	11.5	7.6	25
5	28	96	1637	Blue River	03	2.8	16	40.5	9.5	11.4	7.5	25
5	28	96	1637	Blue River	03	2.8	18	40.5	9.2	11.4	7.4	24
5	28	96	1637	Blue River	03	2.8	20	40.5	9.0	11.5	7.4	24
5	28	96	1637	Blue River	03	2.8	22	40.5	8.9	11.5	7.3	24
5	28	96	1637	Blue River	03	2.8	24	40.5	8.8	11.6	7.3	23
5	28	96	1637	Blue River	03	2.8	26	40.5	8.7	11.6	7.3	24
5	28	96	1637	Blue River	03	2.8	28	40.5	8.6	11.6	7.3	24
5	28	96	1637	Blue River	03	2.8	30	40.5	8.4	11.6	7.2	24
5	28	96	1637	Blue River	03	2.8	32	40.5	8.3	11.5	7.2	23
5	28	96	1637	Blue River	03	2.8	34	40.5	8.1	11.4	7.2	24
5	28	96	1637	Blue River	03	2.8	36	40.5	7.3	10.0	7.1	26
5	28	96	1637	Blue River	03	2.8	38	40.5	6.8	8.4	6.9	30
5	28	96	1637	Blue River	03	2.8	40	40.5	6.5	6.4	6.7	34
5	28	96	1700	Blue River	04	2.7	0	23.0	15.4	11.1	8.8	26
5	28	96	1700	Blue River	04	2.7	2	23.0	15.2	11.2	8.7	26
5	28	96	1700	Blue River	04	2.7	4	23.0	14.9	11.2	8.6	25
5	28	96	1700	Blue River	04	2.7	6	23.0	14.1	11.2	8.5	26
5	28	96	1700	Blue River	04	2.7	8	23.0	11.4	11.2	8.3	26
5	28	96	1700	Blue River	04	2.7	10	23.0	10.6	11.4	8.1	25
5	28	96	1700	Blue River	04	2.7	12	23.0	10.0	11.4	7.9	25
5	28	96	1700	Blue River	04	2.7	14	23.0	9.7	11.4	7.8	25
5	28	96	1700	Blue River	04	2.7	16	23.0	9.4	11.5	7.8	25
5	28	96	1700	Blue River	04	2.7	18	23.0	9.2	11.5	7.7	25
5	28	96	1700	Blue River	04	2.7	20	23.0	9.1	11.5	7.6	25
5	28	96	1700	Blue River	04	2.7	22	23.0	8.9	11.1	7.6	27
7	9	96	904	Blue River	1	6.7	0	67.9	21	8.9	7.9	27
7	9	96	904	Blue River	1	6.7	2	67.9	21	8.9	7.7	27
7	9	96	904	Blue River	1	6.7	4	67.9	20.3	9.6	8	28
7	9	96	904	Blue River	1	6.7	6	67.9	18.7	11.6	8.6	29
7	9	96	904	Blue River	1	6.7	7	67.9	17.7	13.5	9	30
7	9	96	904	Blue River	1	6.7	8	67.9	16.8	13.3	8.9	30
7	9	96	904	Blue River	1	6.7	9	67.9	15.5	11.5	8.4	27
7	9	96	904	Blue River	1	6.7	10	67.9	14.6	10.5	8	27
7	9	96	904	Blue River	1	6.7	11	67.9	13.7	10	7.7	26
7	9	96	904	Blue River	1	6.7	12	67.9	12.4	9.8	7.4	26
7	9	96	904	Blue River	1	6.7	14	67.9	11	9.6	7.2	26
7	9	96	904	Blue River	1	6.7	16	67.9	10.4	9.6	7.1	25
7	9	96	904	Blue River	1	6.7	18	67.9	9.9	9.7	7	25
7	9	96	904	Blue River	1	6.7	20	67.9	9.7	9.8	7	25
7	9	96	904	Blue River	1	6.7	22	67.9	9.5	9.9	6.9	25
7	9	96	904	Blue River	1	6.7	24	67.9	9.1	9.9	6.9	24
7	9	96	904	Blue River	1	6.7	26	67.9	9	9.9	6.8	24
7	9	96	904	Blue River	1	6.7	28	67.9	8.9	9.9	6.8	24

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7	9	96	904	Blue River	1	6.7	30	67.9	8.8	9.7	6.7	23
7	9	96	904	Blue River	1	6.7	32	67.9	8.7	9.6	6.7	24
7	9	96	904	Blue River	1	6.7	34	67.9	8.6	9.5	6.7	24
7	9	96	904	Blue River	1	6.7	36	67.9	8.5	9.4	6.6	25
7	9	96	904	Blue River	1	6.7	38	67.9	8.5	9.4	6.5	24
7	9	96	904	Blue River	1	6.7	40	67.9	8.5	9.5	6.5	24
7	9	96	904	Blue River	1	6.7	42	67.9	8.4	9.4	6.5	24
7	9	96	904	Blue River	1	6.7	44	67.9	8.3	9.4	6.5	24
7	9	96	904	Blue River	1	6.7	46	67.9	8.3	9.4	6.5	24
7	9	96	904	Blue River	1	6.7	48	67.9	8.3	9.4	6.4	24
7	9	96	904	Blue River	1	6.7	50	67.9	8.3	9.3	6.5	24
7	9	96	904	Blue River	1	6.7	55	67.9	8.3	9.3	6.4	23
7	9	96	904	Blue River	1	6.7	60	67.9	8.2	9.2	6.4	23
7	9	96	904	Blue River	1	6.7	65	67.9	8.2	9.2	6.4	23
7	9	96	904	Blue River	1	6.7	67.4	67.9	8.2	9.1	6.4	24
7	22	96	1710	Blue River	1	5.5	0	57.3	23.1	8.3	7.7	28
7	22	96	1710	Blue River	1	5.5	2	57.3	22.4	8.3	7.8	28
7	22	96	1710	Blue River	1	5.5	4	57.3	22.2	8.2	7.8	28
7	22	96	1710	Blue River	1	5.5	6	57.3	21.5	8.3	7.6	28
7	22	96	1710	Blue River	1	5.5	8	57.3	18.9	10.1	8.2	29
7	22	96	1710	Blue River	1	5.5	10	57.3	15.7	10.6	8.1	26
7	22	96	1710	Blue River	1	5.5	12	57.3	12.2	8.8	7.7	26
7	22	96	1710	Blue River	1	5.5	14	57.3	11.1	8.5	7.6	26
7	22	96	1710	Blue River	1	5.5	16	57.3	10.7	8.7	7.5	26
7	22	96	1710	Blue River	1	5.5	18	57.3	10	9.1	7.4	24
7	22	96	1710	Blue River	1	5.5	20	57.3	9.7	9.2	7.3	26
7	22	96	1710	Blue River	1	5.5	22	57.3	9.5	9.3	7.3	25
7	22	96	1710	Blue River	1	5.5	24	57.3	9.3	9.4	7.2	24
7	22	96	1710	Blue River	1	5.5	26	57.3	9.1	9.3	7.1	24
7	22	96	1710	Blue River	1	5.5	28	57.3	9	9.2	7.2	25
7	22	96	1710	Blue River	1	5.5	30	57.3	8.9	9.4	7.1	25
7	22	96	1710	Blue River	1	5.5	32	57.3	8.8	9.3	7.1	26
7	22	96	1710	Blue River	1	5.5	34	57.3	8.7	9.1	7.1	26
7	22	96	1710	Blue River	1	5.5	36	57.3	8.6	8.7	7	25
7	22	96	1710	Blue River	1	5.5	38	57.3	8.5	8.6	7	25
7	22	96	1710	Blue River	1	5.5	40	57.3	8.4	8.8	7.1	26
7	22	96	1710	Blue River	1	5.5	42	57.3	8.4	8.8	7.1	26
7	22	96	1710	Blue River	1	5.5	44	57.3	8.4	8.7	7.1	26
7	22	96	1710	Blue River	1	5.5	46	57.3	8.4	8.6	6.9	26
7	22	96	1710	Blue River	1	5.5	48	57.3	8.4	8.6	6.8	25
7	22	96	1710	Blue River	1	5.5	50	57.3	8.3	8.6	6.9	24
7	22	96	1710	Blue River	1	5.5	52	57.3	8.3	8.5	6.8	24
7	22	96	1710	Blue River	1	5.5	54	57.3	8.3	8.3	6.8	25
7	22	96	1710	Blue River	1	5.5	56	57.3	8.3	8.4	6.7	26
7	22	96	1710	Blue River	1	5.5	56.6	57.3	8.3	8.4	6.7	25
7	9	96	1245	Blue River	2	6.6	0	39	22	9.1	7.8	27

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7	9	96	1245	Blue River	2	6.6	2	39	22	9	7.9	27
7	9	96	1245	Blue River	2	6.6	4	39	21.8	9	7.9	27
7	9	96	1245	Blue River	2	6.6	6	39	20.3	10.2	8.3	28
7	9	96	1245	Blue River	2	6.6	8	39	17.6	12.4	8.8	28
7	9	96	1245	Blue River	2	6.6	10	39	14.9	10.9	8	27
7	9	96	1245	Blue River	2	6.6	12	39	12.8	10.1	7.7	26
7	9	96	1245	Blue River	2	6.6	14	39	11.7	10.1	7.5	24
7	9	96	1245	Blue River	2	6.6	16	39	10.9	10	7.2	24
7	9	96	1245	Blue River	2	6.6	18	39	10.3	10	7	24
7	9	96	1245	Blue River	2	6.6	20	39	9.9	9.9	6.9	24
7	9	96	1245	Blue River	2	6.6	22	39	9.6	9.9	6.9	25
7	9	96	1245	Blue River	2	6.6	24	39	9.4	10	6.8	24
7	9	96	1245	Blue River	2	6.6	26	39	9.2	10.1	6.8	23
7	9	96	1245	Blue River	2	6.6	28	39	9	10	6.8	23
7	9	96	1245	Blue River	2	6.6	30	39	8.9	10.1	6.7	24
7	9	96	1245	Blue River	2	6.6	32	39	8.8	10	6.7	24
7	9	96	1245	Blue River	2	6.6	34	39	8.7	9.9	6.7	24
7	9	96	1245	Blue River	2	6.6	36	39	8.7	9.8	6.7	24
7	9	96	1245	Blue River	2	6.6	38	39	8.5	9	6.6	25
7	9	96	1334	Blue River	3	6.7	0	35.3	22.5	9	7.9	27
7	9	96	1334	Blue River	3	6.7	2	35.3	22.3	8.9	7.8	27
7	9	96	1334	Blue River	3	6.7	4	35.3	22.2	9	7.9	27
7	9	96	1334	Blue River	3	6.7	6	35.3	20.7	9.9	8.1	28
7	9	96	1334	Blue River	3	6.7	7	35.3	19.3	11.2	8.5	29
7	9	96	1334	Blue River	3	6.7	8	35.3	17.4	12.5	8.7	29
7	9	96	1334	Blue River	3	6.7	9	35.3	16.1	11.9	8.6	28
7	9	96	1334	Blue River	3	6.7	10	35.3	15.3	11	8.2	28
7	9	96	1334	Blue River	3	6.7	11	35.3	14.2	10.2	7.8	27
7	9	96	1334	Blue River	3	6.7	12	35.3	13.2	10	7.6	26
7	9	96	1334	Blue River	3	6.7	14	35.3	11.8	10.2	7.5	25
7	9	96	1334	Blue River	3	6.7	16	35.3	11	10.1	7.4	25
7	9	96	1334	Blue River	3	6.7	18	35.3	10.3	10	7.3	25
7	9	96	1334	Blue River	3	6.7	20	35.3	9.9	9.9	7.2	24
7	9	96	1334	Blue River	3	6.7	22	35.3	9.6	9.9	7.1	24
7	9	96	1334	Blue River	3	6.7	24	35.3	9.4	9.9	7.1	24
7	9	96	1334	Blue River	3	6.7	26	35.3	9.3	9.6	7	24
7	9	96	1334	Blue River	3	6.7	28	35.3	9.1	9.6	6.9	24
7	9	96	1334	Blue River	3	6.7	30	35.3	9	9.7	6.9	24
7	9	96	1334	Blue River	3	6.7	32	35.3	8.9	9.5	6.8	24
7	9	96	1334	Blue River	3	6.7	34	35.3	8.7	9.2	6.7	25
7	9	96	1407	Blue River	4	6.5	0	27.3	22.3	8.9	7.6	28
7	9	96	1407	Blue River	4	6.5	2	27.3	22.3	8.8	7.6	28
7	9	96	1407	Blue River	4	6.5	4	27.3	22.3	8.8	7.6	28
7	9	96	1407	Blue River	4	6.5	6	27.3	22.2	8.8	7.6	27
7	9	96	1407	Blue River	4	6.5	8	27.3	18.1	10	7.9	30
7	9	96	1407	Blue River	4	6.5	9	27.3	16.6	10.1	7.7	30

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7	9	96	1407	Blue River	4	6.5	10	27.3	15.8	10.2	7.6	29
7	9	96	1407	Blue River	4	6.5	11	27.3	14.4	9.6	7.4	28
7	9	96	1407	Blue River	4	6.5	12	27.3	13.1	9.8	7.3	27
7	9	96	1407	Blue River	4	6.5	14	27.3	11.6	9.6	7.1	27
7	9	96	1407	Blue River	4	6.5	16	27.3	10.5	9.6	7.1	26
7	9	96	1407	Blue River	4	6.5	18	27.3	10.1	9.2	7	25
7	9	96	1407	Blue River	4	6.5	20	27.3	9.8	8.6	6.8	27
7	9	96	1407	Blue River	4	6.5	22	27.3	9.7	8.4	6.8	26
7	9	96	1407	Blue River	4	6.5	24	27.3	9.4	8.3	6.7	27
7	9	96	1407	Blue River	4	6.5	26	27.3	9.3	8	6.7	26
8	26	96	1030	Blue River	1	6.3	0	66.8	22	9.1	7.3	31
8	26	96	1030	Blue River	1	6.3	2	66.8	22.1	9	7.2	31
8	26	96	1030	Blue River	1	6.3	4	66.8	22.1	9	7.2	30
8	26	96	1030	Blue River	1	6.3	6	66.8	22.1	8.9	7.2	30
8	26	96	1030	Blue River	1	6.3	8	66.8	22	8.9	7.2	30
8	26	96	1030	Blue River	1	6.3	10	66.8	20.9	9.5	7.1	30
8	26	96	1030	Blue River	1	6.3	12	66.8	17.8	9.9	6.9	30
8	26	96	1030	Blue River	1	6.3	14	66.8	14.3	9.5	6.8	30
8	26	96	1030	Blue River	1	6.3	16	66.8	12.4	8.5	6.6	30
8	26	96	1030	Blue River	1	6.3	18	66.8	11	8.4	6.6	30
8	26	96	1030	Blue River	1	6.3	20	66.8	10.5	8.9	6.6	28
8	26	96	1030	Blue River	1	6.3	22	66.8	10.1	9.4	6.6	26
8	26	96	1030	Blue River	1	6.3	24	66.8	9.8	9.7	6.6	26
8	26	96	1030	Blue River	1	6.3	26	66.8	9.5	10	6.6	26
8	26	96	1030	Blue River	1	6.3	28	66.8	9.4	9.8	6.6	26
8	26	96	1030	Blue River	1	6.3	30	66.8	9.2	9.9	6.5	25
8	26	96	1030	Blue River	1	6.3	32	66.8	9.1	9.8	6.5	25
8	26	96	1030	Blue River	1	6.3	34	66.8	9	9.7	6.4	25
8	26	96	1030	Blue River	1	6.3	36	66.8	8.9	9.7	6.5	24
8	26	96	1030	Blue River	1	6.3	38	66.8	8.8	9.5	6.5	25
8	26	96	1030	Blue River	1	6.3	40	66.8	8.7	9.1	6.4	25
8	26	96	1030	Blue River	1	6.3	42	66.8	8.7	8.9	6.4	25
8	26	96	1030	Blue River	1	6.3	44	66.8	8.6	8.8	6.4	25
8	26	96	1030	Blue River	1	6.3	46	66.8	8.6	8.8	6.3	27
8	26	96	1030	Blue River	1	6.3	48	66.8	8.6	8.8	6.3	27
8	26	96	1030	Blue River	1	6.3	50	66.8	8.5	8.7	6.3	27
8	26	96	1030	Blue River	1	6.3	52	66.8	8.5	8.6	6.3	27
8	26	96	1030	Blue River	1	6.3	54	66.8	8.5	8.5	6.3	27
8	26	96	1030	Blue River	1	6.3	56	66.8	8.5	8.5	6.3	26
8	26	96	1030	Blue River	1	6.3	58	66.8	8.5	8.4	6.2	28
8	26	96	1030	Blue River	1	6.3	60	66.8	8.5	8.4	6.2	28
8	26	96	1030	Blue River	1	6.3	62	66.8	8.5	8.4	6.2	29
8	26	96	1030	Blue River	1	6.3	64	66.8	8.5	8.3	6.3	29
8	26	96	1030	Blue River	1	6.3	66	66.8	8.5	8.2	6.2	29
8	26	96	1030	Blue River	1	6.3	66.3	66.8	8.5	8	6.2	29
8	28	96	1445	Blue River	2	6.1	0	41.3	23	9	7.4	32

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8	28	96	1445	Blue River	2	6.1	2	41.3	23	9.2	7.4	32
8	28	96	1445	Blue River	2	6.1	4	41.3	22.9	9.1	7.3	31
8	28	96	1445	Blue River	2	6.1	6	41.3	22.7	9	7.2	30
8	28	96	1445	Blue River	2	6.1	8	41.3	22.3	8.9	7.2	30
8	28	96	1445	Blue River	2	6.1	10	41.3	21	9.6	7.1	30
8	28	96	1445	Blue River	2	6.1	12	41.3	17.9	10	7	30
8	28	96	1445	Blue River	2	6.1	14	41.3	14.3	9.2	6.9	30
8	28	96	1445	Blue River	2	6.1	16	41.3	12.5	8.3	6.8	29
8	28	96	1445	Blue River	2	6.1	18	41.3	11	8.2	6.6	29
8	28	96	1445	Blue River	2	6.1	20	41.3	10.6	8.9	6.6	28
8	28	96	1445	Blue River	2	6.1	22	41.3	10	9.4	6.6	26
8	28	96	1445	Blue River	2	6.1	24	41.3	9.8	9.6	6.6	27
8	28	96	1445	Blue River	2	6.1	26	41.3	9.7	10.2	6.5	26
8	28	96	1445	Blue River	2	6.1	28	41.3	9.4	9.8	6.6	25
8	28	96	1445	Blue River	2	6.1	30	41.3	9.3	9.9	6.6	25
8	28	96	1445	Blue River	2	6.1	32	41.3	9.2	9.9	6.5	25
8	28	96	1445	Blue River	2	6.1	34	41.3	9.1	9.7	6.4	25
8	28	96	1445	Blue River	2	6.1	36	41.3	9	8	6.3	24
8	28	96	1445	Blue River	2	6.1	38	41.3	8.8	5.2	6.4	25
8	28	96	1445	Blue River	2	6.1	40	41.3	8.7	5	6.4	26
8	28	96	1515	Blue River	3	5.8	0	34.6	22.7	9.2	7.4	32
8	28	96	1515	Blue River	3	5.8	2	34.6	22.6	9	7.3	31
8	28	96	1515	Blue River	3	5.8	4	34.6	22.5	9.1	7.2	30
8	28	96	1515	Blue River	3	5.8	6	34.6	22.5	8.9	7.2	30
8	28	96	1515	Blue River	3	5.8	8	34.6	22.4	8.8	7.1	30
8	28	96	1515	Blue River	3	5.8	10	34.6	22	10.2	7	30
8	28	96	1515	Blue River	3	5.8	12	34.6	18	10	6.9	30
8	28	96	1515	Blue River	3	5.8	14	34.6	14.5	9.7	6.8	30
8	28	96	1515	Blue River	3	5.8	16	34.6	12.3	8.7	6.7	29
8	28	96	1515	Blue River	3	5.8	18	34.6	11.3	8.5	6.6	29
8	28	96	1515	Blue River	3	5.8	20	34.6	10.4	8.2	6.6	28
8	28	96	1515	Blue River	3	5.8	22	34.6	10.1	8.2	6.6	27
8	28	96	1515	Blue River	3	5.8	24	34.6	9.9	8	6.5	26
8	28	96	1515	Blue River	3	5.8	26	34.6	9.5	7.6	6.5	26
8	28	96	1515	Blue River	3	5.8	28	34.6	9.4	5	6.5	26
8	28	96	1515	Blue River	3	5.8	30	34.6	9.1	2.6	6.4	29
8	28	96	1515	Blue River	3	5.8	32	34.6	9.1	1.8	6.3	32
8	28	96	1515	Blue River	3	5.8	34	34.6	8.9	0.5	6.3	35
8	28	96	1540	Blue River	4	5.9	0	25.3	22.2	9.2	7.3	31
8	28	96	1540	Blue River	4	5.9	2	25.3	22.1	9.1	7.2	30
8	28	96	1540	Blue River	4	5.9	4	25.3	22	9	7.1	30
8	28	96	1540	Blue River	4	5.9	6	25.3	22	9	7.2	30
8	28	96	1540	Blue River	4	5.9	8	25.3	21.9	8.9	7.1	29
8	28	96	1540	Blue River	4	5.9	10	25.3	21.3	9.1	7	29
8	28	96	1540	Blue River	4	5.9	12	25.3	17.9	9.6	6.9	29
8	28	96	1540	Blue River	4	5.9	14	25.3	15	9.6	6.9	29

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8	28	96	1540	Blue River	4	5.9	16	25.3	13	8.2	6.7	29
8	28	96	1540	Blue River	4	5.9	18	25.3	11.2	8.2	6.6	29
8	28	96	1540	Blue River	4	5.9	20	25.3	10.6	7	6.6	28
8	28	96	1540	Blue River	4	5.9	22	25.3	10	6.2	6.5	26
8	28	96	1540	Blue River	4	5.9	24	25.3	9.9	6	6.5	27
9	23	96	1125	Blue River	1	6.3	0	59.3	18.4	8.8	6.5	32
9	23	96	1125	Blue River	1	6.3	2	59.3	18.4	8.7	6.7	32
9	23	96	1125	Blue River	1	6.3	4	59.3	18.4	8.7	6.7	31
9	23	96	1125	Blue River	1	6.3	6	59.3	18.4	8.7	6.7	31
9	23	96	1125	Blue River	1	6.3	8	59.3	18.4	8.8	6.7	31
9	23	96	1125	Blue River	1	6.3	10	59.3	18.4	8.7	6.8	31
9	23	96	1125	Blue River	1	6.3	12	59.3	18.4	8.7	6.8	31
9	23	96	1125	Blue River	1	6.3	14	59.3	18.3	8.7	6.8	31
9	23	96	1125	Blue River	1	6.3	16	59.3	17.5	7.9	6.7	30
9	23	96	1125	Blue River	1	6.3	18	59.3	16.1	7.4	6.6	30
9	23	96	1125	Blue River	1	6.3	20	59.3	14.7	6.9	6.5	30
9	23	96	1125	Blue River	1	6.3	22	59.3	13.1	7	6.4	29
9	23	96	1125	Blue River	1	6.3	24	59.3	12.2	7	6.3	29
9	23	96	1125	Blue River	1	6.3	26	59.3	11.4	7.3	6.3	30
9	23	96	1125	Blue River	1	6.3	28	59.3	10.8	7.6	6.3	27
9	23	96	1125	Blue River	1	6.3	30	59.3	10.7	7.8	6.3	28
9	23	96	1125	Blue River	1	6.3	32	59.3	10.3	8.3	6.6	28
9	23	96	1125	Blue River	1	6.3	34	59.3	10.2	8.4	6.6	28
9	23	96	1125	Blue River	1	6.3	36	59.3	10.1	8.6	6.5	27
9	23	96	1125	Blue River	1	6.3	38	59.3	9.9	8.9	6.4	26
9	23	96	1125	Blue River	1	6.3	40	59.3	9.9	8.9	6.4	25
9	23	96	1125	Blue River	1	6.3	42	59.3	9.8	8.9	6.5	25
9	23	96	1125	Blue River	1	6.3	44	59.3	9.7	8.7	6.4	25
9	23	96	1125	Blue River	1	6.3	46	59.3	9.6	8.1	6.4	27
9	23	96	1125	Blue River	1	6.3	48	59.3	9.6	7.8	6.3	27
9	23	96	1125	Blue River	1	6.3	50	59.3	9.6	7.6	6.3	28
9	23	96	1125	Blue River	1	6.3	52	59.3	9.6	7.4	6.2	28
9	23	96	1125	Blue River	1	6.3	54	59.3	9.5	6.8	6.2	30
9	23	96	1125	Blue River	1	6.3	56	59.3	9.4	6.4	6.1	29
9	23	96	1125	Blue River	1	6.3	58	59.3	9.3	6.4	6	29
9	23	96	1125	Blue River	1	6.3	59	59.3	8.9	6.1	6	30
9	23	96	1425	Blue River	2	6.3	0	37.5	19.4	8.8	7.1	32
9	23	96	1425	Blue River	2	6.3	2	37.5	18.7	8.8	7	32
9	23	96	1425	Blue River	2	6.3	4	37.5	18.6	8.8	7	32
9	23	96	1425	Blue River	2	6.3	6	37.5	18.5	8.8	7	31
9	23	96	1425	Blue River	2	6.3	8	37.5	18.5	8.8	7	31
9	23	96	1425	Blue River	2	6.3	10	37.5	18.5	8.8	7	32
9	23	96	1425	Blue River	2	6.3	12	37.5	18.4	8.8	7	32
9	23	96	1425	Blue River	2	6.3	14	37.5	18.1	8.4	6.9	32
9	23	96	1425	Blue River	2	6.3	16	37.5	17.2	8	6.8	33
9	23	96	1425	Blue River	2	6.3	18	37.5	15.6	7.6	6.6	30

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9	23	96	1425	Blue River	2	6.3	20	37.5	14.1	7.5	6.5	28
9	23	96	1425	Blue River	2	6.3	22	37.5	12.9	7.5	6.4	28
9	23	96	1425	Blue River	2	6.3	24	37.5	12	7.3	6.4	29
9	23	96	1425	Blue River	2	6.3	26	37.5	11.4	7.8	6.3	27
9	23	96	1425	Blue River	2	6.3	28	37.5	11.1	7.5	6.3	28
9	23	96	1425	Blue River	2	6.3	30	37.5	10.6	8	6.3	27
9	23	96	1425	Blue River	2	6.3	32	37.5	10.4	6.4	6.2	31
9	23	96	1425	Blue River	2	6.3	34	37.5	9.8	6.4	6.1	32
9	23	96	1425	Blue River	2	6.3	36	37.5	9.7	6.5	6.1	31
9	23	96	1453	Blue River	3	5.7	0	33.5	18.8	8.9	7.2	32
9	23	96	1453	Blue River	3	5.7	2	33.5	18.4	8.9	7.1	32
9	23	96	1453	Blue River	3	5.7	4	33.5	18.3	8.8	7.1	31
9	23	96	1453	Blue River	3	5.7	6	33.5	18.3	8.8	7.1	32
9	23	96	1453	Blue River	3	5.7	8	33.5	18.2	8.8	7	30
9	23	96	1453	Blue River	3	5.7	10	33.5	18.2	8.8	7	32
9	23	96	1453	Blue River	3	5.7	12	33.5	18.1	8.7	7	30
9	23	96	1453	Blue River	3	5.7	14	33.5	18	8.6	7	32
9	23	96	1453	Blue River	3	5.7	16	33.5	17.4	7.8	6.8	33
9	23	96	1453	Blue River	3	5.7	18	33.5	15.9	7.5	6.6	31
9	23	96	1453	Blue River	3	5.7	20	33.5	14.5	6.8	6.5	31
9	23	96	1453	Blue River	3	5.7	22	33.5	13.1	6.5	6.4	31
9	23	96	1453	Blue River	3	5.7	24	33.5	11.8	5.8	6.2	32
9	23	96	1453	Blue River	3	5.7	26	33.5	11.1	4.7	6.1	35
9	23	96	1453	Blue River	3	5.7	28	33.5	9.5	1.5	6	41
9	23	96	1453	Blue River	3	5.7	30	33.5	8.3	0.6	6	50
9	23	96	1453	Blue River	3	5.7	32	33.5	7.7	0.2	5.9	63
9	23	96	1530	Blue River	4	4.9	0	17.6	19.1	8.8	7.2	32
9	23	96	1530	Blue River	4	4.9	2	17.6	18.3	8.8	7.1	32
9	23	96	1530	Blue River	4	4.9	4	17.6	18.2	8.8	7.1	32
9	23	96	1530	Blue River	4	4.9	6	17.6	18.1	8.7	7	32
9	23	96	1530	Blue River	4	4.9	8	17.6	18.1	8.7	7	31
9	23	96	1530	Blue River	4	4.9	10	17.6	18.1	8.7	7	32
9	23	96	1530	Blue River	4	4.9	12	17.6	18	8.7	7	32
9	23	96	1530	Blue River	4	4.9	14	17.6	17.7	8.6	7	33
9	23	96	1530	Blue River	4	4.9	16	17.6	17	8.7	6.9	34
4	17	96	1045	Cougar	1	4.8	0	108.8	10	12.8	7.3	29
4	17	96	1045	Cougar	1	4.8	2	108.8	10	12.7	7.2	29
4	17	96	1045	Cougar	1	4.8	4	108.8	10	12.7	7.2	29
4	17	96	1045	Cougar	1	4.8	6	108.8	10	12.6	7.3	29
4	17	96	1045	Cougar	1	4.8	8	108.8	9.2	12.9	7.3	29
4	17	96	1045	Cougar	1	4.8	10	108.8	7.9	13.2	7.2	29
4	17	96	1045	Cougar	1	4.8	12	108.8	7.4	13.2	7.2	29
4	17	96	1045	Cougar	1	4.8	14	108.8	7.2	13.1	7.1	29
4	17	96	1045	Cougar	1	4.8	16	108.8	6.8	13.1	7.1	28
4	17	96	1045	Cougar	1	4.8	18	108.8	6.5	13.1	7.1	27
4	17	96	1045	Cougar	1	4.8	20	108.8	6.4	13.1	7.1	30

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4	17	96	1045	Cougar	1	4.8	22	108.8	6.2	13.1	7	30
4	17	96	1045	Cougar	1	4.8	24	108.8	6	13.1	7	30
4	17	96	1045	Cougar	1	4.8	26	108.8	6	13.1	7	30
4	17	96	1045	Cougar	1	4.8	28	108.8	5.9	13.1	7	30
4	17	96	1045	Cougar	1	4.8	30	108.8	5.8	13.1	7	30
4	17	96	1045	Cougar	1	4.8	32	108.8	5.7	13.1	7	32
4	17	96	1045	Cougar	1	4.8	34	108.8	5.6	13.1	7	31
4	17	96	1045	Cougar	1	4.8	36	108.8	5.4	13.2	6.9	31
4	17	96	1045	Cougar	1	4.8	38	108.8	5.3	13.2	6.9	32
4	17	96	1045	Cougar	1	4.8	40	108.8	5.2	13.2	6.9	33
4	17	96	1045	Cougar	1	4.8	42	108.8	5	13.2	6.9	33
4	17	96	1045	Cougar	1	4.8	44	108.8	4.9	13.1	6.8	33
4	17	96	1045	Cougar	1	4.8	46	108.8	4.8	13	6.8	33
4	17	96	1045	Cougar	1	4.8	48	108.8	4.8	13	6.8	30
4	17	96	1045	Cougar	1	4.8	50	108.8	4.7	12.9	6.8	30
4	17	96	1045	Cougar	1	4.8	52	108.8	4.7	12.9	6.7	32
4	17	96	1045	Cougar	1	4.8	54	108.8	4.7	12.9	6.7	30
4	17	96	1045	Cougar	1	4.8	56	108.8	4.7	12.9	6.7	30
4	17	96	1045	Cougar	1	4.8	58	108.8	4.7	12.9	6.7	31
4	17	96	1045	Cougar	1	4.8	60	108.8	4.7	12.8	6.7	32
4	17	96	1045	Cougar	1	4.8	62	108.8	4.7	12.8	6.7	30
4	17	96	1045	Cougar	1	4.8	64	108.8	4.7	12.8	6.7	30
4	17	96	1045	Cougar	1	4.8	66	108.8	4.7	12.8	6.6	30
4	17	96	1045	Cougar	1	4.8	68	108.8	4.7	12.8	6.6	30
4	17	96	1045	Cougar	1	4.8	70	108.8	4.7	12.7	6.6	31
4	17	96	1045	Cougar	1	4.8	72	108.8	4.7	12.7	6.6	30
4	17	96	1045	Cougar	1	4.8	74	108.8	4.7	12.7	6.6	30
4	17	96	1045	Cougar	1	4.8	76	108.8	4.7	12.7	6.6	31
4	17	96	1045	Cougar	1	4.8	78	108.8	4.7	12.6	6.6	30
4	17	96	1045	Cougar	1	4.8	80	108.8	4.7	12.6	6.6	32
4	17	96	1045	Cougar	1	4.8	82	108.8	4.7	12.5	6.6	30
4	17	96	1045	Cougar	1	4.8	84	108.8	4.7	12.5	6.6	31
4	17	96	1045	Cougar	1	4.8	86	108.8	4.8	12.4	6.6	30
4	17	96	1045	Cougar	1	4.8	88	108.8	4.8	12.3	6.6	30
4	17	96	1045	Cougar	1	4.8	90	108.8	4.8	12.3	6.6	32
4	17	96	1045	Cougar	1	4.8	92	108.8	4.8	12.3	6.6	29
4	17	96	1045	Cougar	1	4.8	94	108.8	4.8	12.2	6.5	30
4	17	96	1045	Cougar	1	4.8	96	108.8	4.8	12.2	6.5	30
4	17	96	1045	Cougar	1	4.8	98	108.8	4.8	12.1	6.5	32
4	17	96	1045	Cougar	1	4.8	100	108.8	4.8	12	6.5	32
4	17	96	1045	Cougar	1	4.8	102	108.8	4.8	11.8	6.5	33
4	17	96	1045	Cougar	1	4.8	104	108.8	4.8	11.6	6.5	32
4	17	96	1045	Cougar	1	4.8	106	108.8	4.8	10.4	6.5	32
4	17	96	1045	Cougar	1	4.8	108	108.8	4.8	9.9	6.4	34
4	17	96	1045	Cougar	1	4.8	108.3	108.8	4.8	9.8	6.4	35
4	17	96	1420	Cougar	2	4	0	102.5	10.5	12.9	7.3	30

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4	17	96	1420	Cougar	2	4	2	102.5	10.2	12.9	7.2	30
4	17	96	1420	Cougar	2	4	4	102.5	10.1	12.8	7.2	30
4	17	96	1420	Cougar	2	4	6	102.5	9.4	13	7.2	30
4	17	96	1420	Cougar	2	4	8	102.5	8.5	13.2	7.2	30
4	17	96	1420	Cougar	2	4	10	102.5	7.7	13.3	7.1	30
4	17	96	1420	Cougar	2	4	12	102.5	7.3	13.3	7.1	30
4	17	96	1420	Cougar	2	4	14	102.5	7.1	13.2	7.1	30
4	17	96	1420	Cougar	2	4	16	102.5	6.9	13.2	7.1	31
4	17	96	1420	Cougar	2	4	18	102.5	6.6	13.1	7.1	31
4	17	96	1420	Cougar	2	4	20	102.5	6.5	13.1	7	32
4	17	96	1420	Cougar	2	4	22	102.5	6.3	13.1	7	32
4	17	96	1420	Cougar	2	4	24	102.5	6.2	13.1	7	32
4	17	96	1420	Cougar	2	4	26	102.5	6	13.1	7	33
4	17	96	1420	Cougar	2	4	28	102.5	5.9	13.1	7	32
4	17	96	1420	Cougar	2	4	30	102.5	5.8	13.2	7	30
4	17	96	1420	Cougar	2	4	32	102.5	5.7	13.2	7	31
4	17	96	1420	Cougar	2	4	34	102.5	5.7	13.2	6.9	30
4	17	96	1420	Cougar	2	4	36	102.5	5.5	13.2	6.9	30
4	17	96	1420	Cougar	2	4	38	102.5	5.3	13.2	6.9	31
4	17	96	1420	Cougar	2	4	40	102.5	5.2	13.2	6.9	30
4	17	96	1420	Cougar	2	4	42	102.5	5.1	13.2	6.9	30
4	17	96	1420	Cougar	2	4	44	102.5	5	13.2	6.9	30
4	17	96	1420	Cougar	2	4	46	102.5	4.9	13	6.9	31
4	17	96	1420	Cougar	2	4	48	102.5	4.8	13	6.8	33
4	17	96	1420	Cougar	2	4	50	102.5	4.8	12.9	6.8	31
4	17	96	1420	Cougar	2	4	52	102.5	4.7	12.9	6.8	33
4	17	96	1420	Cougar	2	4	54	102.5	4.7	12.8	6.8	34
4	17	96	1420	Cougar	2	4	56	102.5	4.7	12.7	6.7	34
4	17	96	1420	Cougar	2	4	58	102.5	4.7	12.6	6.7	32
4	17	96	1420	Cougar	2	4	60	102.5	4.7	12.6	6.7	33
4	17	96	1420	Cougar	2	4	62	102.5	4.7	12.6	6.7	33
4	17	96	1420	Cougar	2	4	64	102.5	4.7	12.5	6.7	34
4	17	96	1420	Cougar	2	4	66	102.5	4.7	12.5	6.7	34
4	17	96	1420	Cougar	2	4	68	102.5	4.7	12.5	6.6	34
4	17	96	1420	Cougar	2	4	70	102.5	4.7	12.5	6.6	33
4	17	96	1420	Cougar	2	4	72	102.5	4.7	12.5	6.6	33
4	17	96	1420	Cougar	2	4	74	102.5	4.7	12.4	6.6	33
4	17	96	1420	Cougar	2	4	76	102.5	4.7	12.4	6.6	33
4	17	96	1420	Cougar	2	4	78	102.5	4.7	12.4	6.6	33
4	17	96	1420	Cougar	2	4	80	102.5	4.7	12.4	6.6	32
4	17	96	1420	Cougar	2	4	82	102.5	4.7	12.3	6.5	32
4	17	96	1420	Cougar	2	4	84	102.5	4.8	12.3	6.5	30
4	17	96	1420	Cougar	2	4	86	102.5	4.8	12.2	6.5	30
4	17	96	1420	Cougar	2	4	88	102.5	4.8	12.1	6.5	30
4	17	96	1420	Cougar	2	4	90	102.5	4.8	12.1	6.5	30
4	17	96	1420	Cougar	2	4	92	102.5	4.8	12.1	6.5	30

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4	17	96	1420	Cougar	2	4	94	102.5	4.8	12.1	6.5	30
4	17	96	1420	Cougar	2	4	96	102.5	4.8	11.9	6.5	30
4	17	96	1420	Cougar	2	4	98	102.5	4.8	11.9	6.5	30
4	17	96	1420	Cougar	2	4	100	102.5	4.8	11.8	6.5	30
4	17	96	1420	Cougar	2	4	102	102.5	4.8	11.8	6.5	30
4	17	96	1506	Cougar	3	4.2	0	60.3	10.4	12.7	7.4	30
4	17	96	1506	Cougar	3	4.2	2	60.3	10.4	12.7	7.3	30
4	17	96	1506	Cougar	3	4.2	4	60.3	10.2	12.7	7.3	30
4	17	96	1506	Cougar	3	4.2	6	60.3	8.6	13.1	7.3	30
4	17	96	1506	Cougar	3	4.2	8	60.3	8.2	13.3	7.3	30
4	17	96	1506	Cougar	3	4.2	10	60.3	7.7	13.1	7.2	32
4	17	96	1506	Cougar	3	4.2	12	60.3	7.4	13.1	7.2	30
4	17	96	1506	Cougar	3	4.2	14	60.3	7.2	13.1	7.2	30
4	17	96	1506	Cougar	3	4.2	16	60.3	7.1	13.1	7.2	31
4	17	96	1506	Cougar	3	4.2	18	60.3	6.8	13.1	7.1	31
4	17	96	1506	Cougar	3	4.2	20	60.3	6.5	13.1	7.1	31
4	17	96	1506	Cougar	3	4.2	22	60.3	6.3	13.1	7.1	33
4	17	96	1506	Cougar	3	4.2	24	60.3	6.2	13.1	7.1	32
4	17	96	1506	Cougar	3	4.2	26	60.3	6.1	13.1	7.1	31
4	17	96	1506	Cougar	3	4.2	28	60.3	6	13.1	7.1	34
4	17	96	1506	Cougar	3	4.2	30	60.3	6	13.1	7.1	34
4	17	96	1506	Cougar	3	4.2	32	60.3	5.9	13.1	7.1	33
4	17	96	1506	Cougar	3	4.2	34	60.3	5.6	13.2	7.1	31
4	17	96	1506	Cougar	3	4.2	36	60.3	5.5	13.2	7	32
4	17	96	1506	Cougar	3	4.2	38	60.3	5.4	13.2	7	34
4	17	96	1506	Cougar	3	4.2	40	60.3	5.3	13.2	7	34
4	17	96	1506	Cougar	3	4.2	42	60.3	5.2	13.2	7	33
4	17	96	1506	Cougar	3	4.2	44	60.3	5.1	13.1	7	31
4	17	96	1506	Cougar	3	4.2	46	60.3	5	13.1	6.9	31
4	17	96	1506	Cougar	3	4.2	48	60.3	4.9	13	6.9	32
4	17	96	1506	Cougar	3	4.2	50	60.3	4.8	2.9	6.9	30
4	17	96	1506	Cougar	3	4.2	52	60.3	4.8	2.9	6.8	32
4	17	96	1506	Cougar	3	4.2	54	60.3	4.8	2.8	6.8	31
4	17	96	1506	Cougar	3	4.2	56	60.3	4.7	2.8	6.8	30
4	17	96	1506	Cougar	3	4.2	58	60.3	4.7	12.5	6.7	30
4	17	96	1506	Cougar	3	4.2	60	60.3	4.7	12.4	6.7	30
4	17	96	1536	Cougar	4	4.2	0	56.1	10.3	12.9	7.4	30
4	17	96	1536	Cougar	4	4.2	2	56.1	10.3	12.8	7.3	30
4	17	96	1536	Cougar	4	4.2	4	56.1	9.3	13.2	7.3	30
4	17	96	1536	Cougar	4	4.2	6	56.1	8.3	13.3	7.3	31
4	17	96	1536	Cougar	4	4.2	8	56.1	7.9	13.2	7.2	31
4	17	96	1536	Cougar	4	4.2	10	56.1	7.7	13.2	7.2	32
4	17	96	1536	Cougar	4	4.2	12	56.1	7.6	13.1	7.2	32
4	17	96	1536	Cougar	4	4.2	14	56.1	7.4	13.1	7.2	32
4	17	96	1536	Cougar	4	4.2	16	56.1	7	13.1	7.2	32
4	17	96	1536	Cougar	4	4.2	18	56.1	6.9	13.1	7.2	32

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4	17	96	1536	Cougar	4	4.2	20	56.1	6.8	13.1	7.1	31
4	17	96	1536	Cougar	4	4.2	22	56.1	6.6	13.1	7.1	32
4	17	96	1536	Cougar	4	4.2	24	56.1	6.4	13.2	7.1	31
4	17	96	1536	Cougar	4	4.2	26	56.1	6.3	13.2	7.1	32
4	17	96	1536	Cougar	4	4.2	28	56.1	6.3	13.2	7.1	31
4	17	96	1536	Cougar	4	4.2	30	56.1	6.2	13.2	7.1	33
4	17	96	1536	Cougar	4	4.2	32	56.1	6	13.2	7.1	32
4	17	96	1536	Cougar	4	4.2	34	56.1	5.9	13.2	7.1	33
4	17	96	1536	Cougar	4	4.2	36	56.1	5.9	13.2	7.1	34
4	17	96	1536	Cougar	4	4.2	38	56.1	5.7	13.1	7.1	35
4	17	96	1536	Cougar	4	4.2	40	56.1	5.6	13.1	7.1	35
4	17	96	1536	Cougar	4	4.2	42	56.1	5.4	13	7	34
4	17	96	1536	Cougar	4	4.2	44	56.1	5.3	12.9	7	34
4	17	96	1536	Cougar	4	4.2	46	56.1	5.2	12.8	7	36
4	17	96	1536	Cougar	4	4.2	48	56.1	5	12.6	6.9	34
4	17	96	1536	Cougar	4	4.2	50	56.1	4.9	12.5	6.9	33
4	17	96	1536	Cougar	4	4.2	52	56.1	4.8	12.4	6.9	33
4	17	96	1536	Cougar	4	4.2	54	56.1	4.8	12.4	6.8	31
4	17	96	1536	Cougar	4	4.2	56	56.1	4.8	12.2	6.8	33
5	29	96	0110	Cougar	01	1.6	0	118.0	14.8	12.3	9.1	28
5	29	96	0110	Cougar	01	1.6	2	118.0	13.8	12.4	9.0	28
5	29	96	0110	Cougar	01	1.6	4	118.0	13.1	12.8	8.8	28
5	29	96	0110	Cougar	01	1.6	6	118.0	11.1	11.8	8.3	25
5	29	96	0110	Cougar	01	1.6	8	118.0	10.3	11.3	7.9	24
5	29	96	0110	Cougar	01	1.6	10	118.0	9.9	11.4	7.7	24
5	29	96	0110	Cougar	01	1.6	12	118.0	9.6	11.4	7.6	24
5	29	96	0110	Cougar	01	1.6	14	118.0	9.2	11.1	7.5	23
5	29	96	0110	Cougar	01	1.6	16	118.0	9.1	11.3	7.3	26
5	29	96	0110	Cougar	01	1.6	18	118.0	9.0	11.2	7.3	25
5	29	96	0110	Cougar	01	1.6	20	118.0	8.7	11.2	7.2	25
5	29	96	0110	Cougar	01	1.6	22	118.0	8.6	11.1	7.2	27
5	29	96	0110	Cougar	01	1.6	24	118.0	8.4	11.2	7.2	26
5	29	96	0110	Cougar	01	1.6	26	118.0	8.2	11.2	7.2	25
5	29	96	0110	Cougar	01	1.6	28	118.0	8.1	11.2	7.1	24
5	29	96	0110	Cougar	01	1.6	30	118.0	8.0	11.2	7.1	24
5	29	96	0110	Cougar	01	1.6	32	118.0	8.0	11.2	7.1	28
5	29	96	0110	Cougar	01	1.6	34	118.0	7.9	11.2	7.0	27
5	29	96	0110	Cougar	01	1.6	36	118.0	7.8	11.2	7.0	27
5	29	96	0110	Cougar	01	1.6	38	118.0	7.7	11.3	7.0	28
5	29	96	0110	Cougar	01	1.6	40	118.0	7.7	11.3	7.0	28
5	29	96	0110	Cougar	01	1.6	42	118.0	7.5	11.3	7.0	28
5	29	96	0110	Cougar	01	1.6	44	118.0	7.1	11.3	7.0	28
5	29	96	0110	Cougar	01	1.6	46	118.0	6.8	11.3	7.0	28
5	29	96	0110	Cougar	01	1.6	48	118.0	6.7	11.3	6.9	27
5	29	96	0110	Cougar	01	1.6	50	118.0	6.4	11.3	6.9	28
5	29	96	0110	Cougar	01	1.6	52	118.0	6.1	11.2	6.9	28

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5	29	96	0110	Cougar	01	1.6	54	118.0	5.6	11.0	6.8	28
5	29	96	0110	Cougar	01	1.6	56	118.0	5.3	10.9	6.8	30
5	29	96	0110	Cougar	01	1.6	58	118.0	5.2	10.9	6.8	31
5	29	96	0110	Cougar	01	1.6	60	118.0	5.1	10.9	6.7	31
5	29	96	0110	Cougar	01	1.6	62	118.0	5.0	10.9	6.7	30
5	29	96	0110	Cougar	01	1.6	64	118.0	4.9	10.9	6.7	28
5	29	96	0110	Cougar	01	1.6	66	118.0	4.9	10.9	6.7	27
5	29	96	0110	Cougar	01	1.6	68	118.0	4.9	10.9	6.7	28
5	29	96	0110	Cougar	01	1.6	70	118.0	4.8	10.8	6.6	28
5	29	96	0110	Cougar	01	1.6	72	118.0	4.8	10.9	6.6	27
5	29	96	0110	Cougar	01	1.6	74	118.0	4.8	10.9	6.6	28
5	29	96	0110	Cougar	01	1.6	76	118.0	4.8	10.9	6.6	27
5	29	96	0110	Cougar	01	1.6	78	118.0	4.7	11.0	6.6	28
5	29	96	0110	Cougar	01	1.6	80	118.0	4.7	11.0	6.6	28
5	29	96	0110	Cougar	01	1.6	82	118.0	4.7	10.9	6.6	28
5	29	96	0110	Cougar	01	1.6	84	118.0	4.7	10.8	6.6	28
5	29	96	0110	Cougar	01	1.6	86	118.0	4.7	10.8	6.5	28
5	29	96	0110	Cougar	01	1.6	88	118.0	4.7	10.8	6.5	28
5	29	96	0110	Cougar	01	1.6	90	118.0	4.7	10.8	6.6	28
5	29	96	0110	Cougar	01	1.6	92	118.0	4.7	10.6	6.5	28
5	29	96	0110	Cougar	01	1.6	94	118.0	4.7	10.6	6.5	28
5	29	96	0110	Cougar	01	1.6	96	118.0	4.7	10.4	6.6	28
5	29	96	0110	Cougar	01	1.6	98	118.0	4.7	10.4	6.5	27
5	29	96	0110	Cougar	01	1.6	100	118.0	4.7	10.1	6.4	28
5	29	96	0110	Cougar	01	1.6	102	118.0	4.7	9.9	6.4	28
5	29	96	0110	Cougar	01	1.6	104	118.0	4.7	9.7	6.4	28
5	29	96	0110	Cougar	01	1.6	106	118.0	4.7	9.6	6.4	28
5	29	96	0110	Cougar	01	1.6	108	118.0	4.7	9.5	6.4	30
5	29	96	0110	Cougar	01	1.6	110	118.0	4.7	9.3	6.4	28
5	29	96	0110	Cougar	01	1.6	112	118.0	4.7	9.3	6.3	30
5	29	96	0110	Cougar	01	1.6	114	118.0	4.7	9.1	6.4	29
5	29	96	0110	Cougar	01	1.6	116	118.0	4.7	9.0	6.3	30
5	29	96	1530	Cougar	02	1.5	0	103.0	14.7	12.6	9.5	28
5	29	96	1530	Cougar	02	1.5	2	103.0	13.8	12.7	9.3	28
5	29	96	1530	Cougar	02	1.5	4	103.0	12.0	12.5	8.9	26
5	29	96	1530	Cougar	02	1.5	6	103.0	11.0	12.0	8.6	25
5	29	96	1530	Cougar	02	1.5	8	103.0	10.3	11.7	8.3	25
5	29	96	1530	Cougar	02	1.5	10	103.0	10.0	11.5	8.1	25
5	29	96	1530	Cougar	02	1.5	12	103.0	9.8	11.4	8.0	26
5	29	96	1530	Cougar	02	1.5	14	103.0	9.4	11.3	7.8	25
5	29	96	1530	Cougar	02	1.5	16	103.0	9.1	11.3	7.7	28
5	29	96	1530	Cougar	02	1.5	18	103.0	8.8	11.3	7.7	27
5	29	96	1530	Cougar	02	1.5	20	103.0	8.7	11.3	7.6	28
5	29	96	1530	Cougar	02	1.5	22	103.0	8.5	11.3	7.6	28
5	29	96	1530	Cougar	02	1.5	24	103.0	8.4	11.2	7.5	27
5	29	96	1530	Cougar	02	1.5	26	103.0	8.2	11.2	7.5	28

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5	29	96	1530	Cougar	02	1.5	28	103.0	8.2	11.2	7.5	27
5	29	96	1530	Cougar	02	1.5	30	103.0	8.1	11.2	7.5	27
5	29	96	1530	Cougar	02	1.5	32	103.0	8.0	11.2	7.4	27
5	29	96	1530	Cougar	02	1.5	34	103.0	7.9	11.3	7.4	26
5	29	96	1530	Cougar	02	1.5	36	103.0	7.8	11.3	7.4	27
5	29	96	1530	Cougar	02	1.5	38	103.0	7.6	11.3	7.3	28
5	29	96	1530	Cougar	02	1.5	40	103.0	7.5	11.3	7.3	25
5	29	96	1530	Cougar	02	1.5	42	103.0	7.4	11.3	7.3	26
5	29	96	1530	Cougar	02	1.5	44	103.0	7.1	11.4	7.3	25
5	29	96	1530	Cougar	02	1.5	46	103.0	7.0	11.3	7.3	27
5	29	96	1530	Cougar	02	1.5	48	103.0	6.7	11.3	7.2	29
5	29	96	1530	Cougar	02	1.5	50	103.0	6.4	11.4	7.2	28
5	29	96	1530	Cougar	02	1.5	55	103.0	5.5	11.0	7.1	28
5	29	96	1530	Cougar	02	1.5	60	103.0	5.1	10.7	7.1	30
5	29	96	1530	Cougar	02	1.5	65	103.0	5.1	10.6	7.0	28
5	29	96	1530	Cougar	02	1.5	70	103.0	5.0	10.6	7.0	30
5	29	96	1530	Cougar	02	1.5	75	103.0	5.0	10.5	6.9	30
5	29	96	1530	Cougar	02	1.5	80	103.0	4.9	10.5	6.9	30
5	29	96	1530	Cougar	02	1.5	85	103.0	4.8	10.6	6.9	30
5	29	96	1530	Cougar	02	1.5	90	103.0	4.8	10.6	6.8	28
5	29	96	1530	Cougar	02	1.5	95	103.0	4.8	10.5	6.8	27
5	29	96	1530	Cougar	02	1.5	100	103.0	4.8	10.5	6.8	28
5	29	96	1610	Cougar	03	1.8	0	83.0	15.8	12.6	9.6	28
5	29	96	1610	Cougar	03	1.8	2	83.0	14.0	13.0	9.3	28
5	29	96	1610	Cougar	03	1.8	4	83.0	11.6	12.2	8.8	27
5	29	96	1610	Cougar	03	1.8	6	83.0	10.4	11.8	8.4	28
5	29	96	1610	Cougar	03	1.8	8	83.0	9.8	11.5	8.1	28
5	29	96	1610	Cougar	03	1.8	10	83.0	9.6	11.3	7.9	27
5	29	96	1610	Cougar	03	1.8	12	83.0	9.3	11.3	7.8	28
5	29	96	1610	Cougar	03	1.8	14	83.0	9.1	11.3	7.7	27
5	29	96	1610	Cougar	03	1.8	16	83.0	9.0	11.3	7.6	27
5	29	96	1610	Cougar	03	1.8	18	83.0	8.8	11.2	7.6	28
5	29	96	1610	Cougar	03	1.8	20	83.0	8.6	11.3	7.5	28
5	29	96	1610	Cougar	03	1.8	22	83.0	8.5	11.2	7.4	28
5	29	96	1610	Cougar	03	1.8	24	83.0	8.4	11.2	7.4	27
5	29	96	1610	Cougar	03	1.8	26	83.0	8.3	11.3	7.4	27
5	29	96	1610	Cougar	03	1.8	28	83.0	8.2	11.3	7.4	28
5	29	96	1610	Cougar	03	1.8	30	83.0	8.2	11.3	7.3	28
5	29	96	1610	Cougar	03	1.8	32	83.0	8.1	11.3	7.3	27
5	29	96	1610	Cougar	03	1.8	34	83.0	8.0	11.3	7.3	28
5	29	96	1610	Cougar	03	1.8	36	83.0	7.9	11.4	7.3	27
5	29	96	1610	Cougar	03	1.8	38	83.0	7.8	11.4	7.2	28
5	29	96	1610	Cougar	03	1.8	40	83.0	7.8	11.4	7.2	29
5	29	96	1610	Cougar	03	1.8	42	83.0	7.8	11.4	7.2	29
5	29	96	1610	Cougar	03	1.8	44	83.0	7.6	11.4	7.2	28
5	29	96	1610	Cougar	03	1.8	46	83.0	7.4	11.4	7.2	28

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5	29	96	1610	Cougar	03	1.8	48	83.0	7.2	11.4	7.1	28
5	29	96	1610	Cougar	03	1.8	50	83.0	7.1	11.3	7.1	28
5	29	96	1610	Cougar	03	1.8	55	83.0	6.6	11.2	7.1	28
5	29	96	1610	Cougar	03	1.8	60	83.0	5.8	11.1	7.0	27
5	29	96	1610	Cougar	03	1.8	65	83.0	5.4	10.5	6.9	29
5	29	96	1610	Cougar	03	1.8	70	83.0	5.2	10.4	6.9	29
5	29	96	1610	Cougar	03	1.8	75	83.0	5.0	10.3	6.9	30
5	29	96	1640	Cougar	04	1.8	0	47.4	15.9	12.4	9.7	28
5	29	96	1640	Cougar	04	1.8	2	47.4	14.3	12.9	9.4	28
5	29	96	1640	Cougar	04	1.8	4	47.4	11.7	12.0	8.9	29
5	29	96	1640	Cougar	04	1.8	6	47.4	10.3	11.4	8.4	29
5	29	96	1640	Cougar	04	1.8	8	47.4	10.0	11.3	8.0	28
5	29	96	1640	Cougar	04	1.8	10	47.4	9.8	11.2	7.8	29
5	29	96	1640	Cougar	04	1.8	12	47.4	9.4	11.2	7.6	30
5	29	96	1640	Cougar	04	1.8	14	47.4	9.2	11.2	7.5	29
5	29	96	1640	Cougar	04	1.8	16	47.4	9.1	11.2	7.4	28
5	29	96	1640	Cougar	04	1.8	18	47.4	8.9	11.3	7.4	28
5	29	96	1640	Cougar	04	1.8	20	47.4	8.8	11.3	7.3	28
5	29	96	1640	Cougar	04	1.8	22	47.4	8.6	11.3	7.3	30
5	29	96	1640	Cougar	04	1.8	24	47.4	8.6	11.3	7.3	28
5	29	96	1640	Cougar	04	1.8	26	47.4	8.5	11.3	7.3	28
5	29	96	1640	Cougar	04	1.8	28	47.4	8.4	11.3	7.3	29
5	29	96	1640	Cougar	04	1.8	30	47.4	8.2	11.3	7.3	28
5	29	96	1640	Cougar	04	1.8	32	47.4	8.2	11.3	7.3	27
5	29	96	1640	Cougar	04	1.8	34	47.4	8.0	11.4	7.2	30
5	29	96	1640	Cougar	04	1.8	36	47.4	8.0	11.3	7.2	28
5	29	96	1640	Cougar	04	1.8	38	47.4	7.9	11.3	7.2	28
5	29	96	1640	Cougar	04	1.8	40	47.4	7.9	11.3	7.2	29
5	29	96	1640	Cougar	04	1.8	42	47.4	7.8	11.3	7.2	28
5	29	96	1640	Cougar	04	1.8	44	47.4	7.6	11.3	7.1	28
5	29	96	1640	Cougar	04	1.8	46	47.4	7.1	11.2	7.1	27
7	10	96	950	Cougar	1	5.1	0	120.3	21.6	9	8.2	30
7	10	96	950	Cougar	1	5.1	2	120.3	21.3	9	8.2	30
7	10	96	950	Cougar	1	5.1	4	120.3	21.1	9.1	8.2	30
7	10	96	950	Cougar	1	5.1	5	120.3	19.7	10.5	8.5	30
7	10	96	950	Cougar	1	5.1	6	120.3	17.7	12	8.7	32
7	10	96	950	Cougar	1	5.1	7	120.3	16.6	12.6	8.8	33
7	10	96	950	Cougar	1	5.1	8	120.3	15.4	13.5	8.9	34
7	10	96	950	Cougar	1	5.1	9	120.3	14.4	14.2	9	35
7	10	96	950	Cougar	1	5.1	10	120.3	13.4	12.8	8.8	31
7	10	96	950	Cougar	1	5.1	11	120.3	12.7	11.9	8.6	30
7	10	96	950	Cougar	1	5.1	12	120.3	12.1	10.8	8.1	27
7	10	96	950	Cougar	1	5.1	14	120.3	11.2	9.8	7.8	27
7	10	96	950	Cougar	1	5.1	16	120.3	10.7	9.5	7.5	27
7	10	96	950	Cougar	1	5.1	18	120.3	10.4	9.2	7.3	25
7	10	96	950	Cougar	1	5.1	20	120.3	9.9	9.2	7.2	25

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7	10	96	950	Cougar	1	5.1	22	120.3	9.7	9.5	7.1	25
7	10	96	950	Cougar	1	5.1	24	120.3	9.4	9.7	7	25
7	10	96	950	Cougar	1	5.1	26	120.3	9.3	9.9	7	26
7	10	96	950	Cougar	1	5.1	28	120.3	9.1	10	6.9	26
7	10	96	950	Cougar	1	5.1	30	120.3	9	10.2	6.9	27
7	10	96	950	Cougar	1	5.1	31	120.3	8.9	10.2	6.9	27
7	10	96	950	Cougar	1	5.1	32	120.3	8.9	10.1	6.9	27
7	10	96	950	Cougar	1	5.1	34	120.3	8.7	10.3	6.9	27
7	10	96	950	Cougar	1	5.1	35	120.3	8.7	10.3	6.9	27
7	10	96	950	Cougar	1	5.1	36	120.3	8.6	10.3	6.9	27
7	10	96	950	Cougar	1	5.1	38	120.3	8.6	10.4	6.9	27
7	10	96	950	Cougar	1	5.1	40	120.3	8.5	10.2	6.8	27
7	10	96	950	Cougar	1	5.1	42	120.3	8.4	10.4	6.8	27
7	10	96	950	Cougar	1	5.1	44	120.3	8.3	10.3	6.8	27
7	10	96	950	Cougar	1	5.1	46	120.3	8.2	10.5	6.8	27
7	10	96	950	Cougar	1	5.1	48	120.3	8.2	10.5	6.8	27
7	10	96	950	Cougar	1	5.1	50	120.3	8.1	10.5	6.7	27
7	10	96	950	Cougar	1	5.1	55	120.3	7.7	10.4	6.8	27
7	10	96	950	Cougar	1	5.1	57.5	120.3	6.7	9.9	6.6	28
7	10	96	950	Cougar	1	5.1	60	120.3	5.8	10.1	6.7	28
7	10	96	950	Cougar	1	5.1	65	120.3	5.3	10	6.6	28
7	10	96	950	Cougar	1	5.1	70	120.3	5.2	10.1	6.6	27
7	10	96	950	Cougar	1	5.1	75	120.3	5.1	10.2	6.6	28
7	10	96	950	Cougar	1	5.1	80	120.3	5	10.1	6.6	28
7	10	96	950	Cougar	1	5.1	85	120.3	4.9	10	6.6	28
7	10	96	950	Cougar	1	5.1	90	120.3	4.9	10.1	6.5	27
7	10	96	950	Cougar	1	5.1	95	120.3	4.8	9.9	6.5	28
7	10	96	950	Cougar	1	5.1	100	120.3	4.8	9.5	6.5	28
7	10	96	950	Cougar	1	5.1	105	120.3	4.8	9	6.5	28
7	10	96	950	Cougar	1	5.1	110	120.3	4.8	8.7	6.4	31
7	10	96	950	Cougar	1	5.1	115	120.3	4.8	8.2	6.5	33
7	10	96	950	Cougar	1	5.1	120	120.3	4.8	8.1	6.4	33
7	23	96	835	Cougar	1	5.7	0	119.5	22.2	8.2	8.1	31
7	23	96	835	Cougar	1	5.7	2	119.5	22.1	8.2	8	31
7	23	96	835	Cougar	1	5.7	4	119.5	22	7.9	8	31
7	23	96	835	Cougar	1	5.7	5	119.5	21.9	8	8.4	31
7	23	96	835	Cougar	1	5.7	6	119.5	17.9	13	9	36
7	23	96	835	Cougar	1	5.7	8	119.5	16.1	14.9	9.2	36
7	23	96	835	Cougar	1	5.7	10	119.5	14.4	13.8	9	34
7	23	96	835	Cougar	1	5.7	12	119.5	13.5	10.9	8.5	35
7	23	96	835	Cougar	1	5.7	14	119.5	12.4	9.7	8.2	34
7	23	96	835	Cougar	1	5.7	16	119.5	11.6	8.9	7.9	30
7	23	96	835	Cougar	1	5.7	18	119.5	10.9	8.3	7.7	28
7	23	96	835	Cougar	1	5.7	20	119.5	10.5	8.1	7.6	27
7	23	96	835	Cougar	1	5.7	22	119.5	10.2	8.1	7.6	26
7	23	96	835	Cougar	1	5.7	24	119.5	9.9	8.1	7.5	27

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7	23	96	835	Cougar	1	5.7	26	119.5	9.6	8.6	7.4	26
7	23	96	835	Cougar	1	5.7	28	119.5	9.4	8.9	7.4	28
7	23	96	835	Cougar	1	5.7	30	119.5	9.2	9	7.4	27
7	23	96	835	Cougar	1	5.7	32	119.5	9.1	9.1	7.4	25
7	23	96	835	Cougar	1	5.7	34	119.5	8.9	9.1	7.3	25
7	23	96	835	Cougar	1	5.7	36	119.5	8.8	9.2	7.3	25
7	23	96	835	Cougar	1	5.7	38	119.5	8.6	9.6	7.3	27
7	23	96	835	Cougar	1	5.7	40	119.5	8.6	9.4	7.3	28
7	23	96	835	Cougar	1	5.7	42	119.5	8.5	9.6	7.2	28
7	23	96	835	Cougar	1	5.7	44	119.5	8.4	9.5	7.2	27
7	23	96	835	Cougar	1	5.7	46	119.5	8.3	9.4	7.2	26
7	23	96	835	Cougar	1	5.7	48	119.5	8.3	9.5	7.2	27
7	23	96	835	Cougar	1	5.7	50	119.5	8.2	9.7	7.2	28
7	23	96	835	Cougar	1	5.7	55	119.5	7	9.4	7.1	30
7	23	96	835	Cougar	1	5.7	60	119.5	5.6	9.1	7.1	28
7	23	96	835	Cougar	1	5.7	65	119.5	5.4	9.2	7	29
7	23	96	835	Cougar	1	5.7	70	119.5	5.2	9.4	7	30
7	23	96	835	Cougar	1	5.7	75	119.5	5.1	9.5	7	31
7	23	96	835	Cougar	1	5.7	80	119.5	5	9.5	7	32
7	23	96	835	Cougar	1	5.7	85	119.5	5	9.5	7	33
7	23	96	835	Cougar	1	5.7	90	119.5	4.9	9.4	6.9	33
7	23	96	835	Cougar	1	5.7	95	119.5	4.8	9.3	6.8	32
7	23	96	835	Cougar	1	5.7	100	119.5	4.8	9.2	6.7	31
7	23	96	835	Cougar	1	5.7	105	119.5	4.8	8.6	6.9	35
7	23	96	835	Cougar	1	5.7	110	119.5	4.8	7.3	6.8	31
7	23	96	835	Cougar	1	5.7	115	119.5	4.8	2	6.7	46
7	23	96	835	Cougar	1	5.7	119	119.5	4.9	1.1	6.6	104
7	10	96	1530	Cougar	2	5.2	0	103.5	22.8	9.3	7.8	31
7	10	96	1530	Cougar	2	5.2	2	103.5	22.5	9.2	7.9	30
7	10	96	1530	Cougar	2	5.2	4	103.5	19	11.2	8.3	31
7	10	96	1530	Cougar	2	5.2	6	103.5	17	12.8	8.5	33
7	10	96	1530	Cougar	2	5.2	8	103.5	14.4	15.4	8.9	35
7	10	96	1530	Cougar	2	5.2	10	103.5	13.1	12.1	8.3	34
7	10	96	1530	Cougar	2	5.2	12	103.5	12.2	10.7	7.9	35
7	10	96	1530	Cougar	2	5.2	14	103.5	11.6	10.4	7.6	31
7	10	96	1530	Cougar	2	5.2	16	103.5	11.1	9.9	7.4	31
7	10	96	1530	Cougar	2	5.2	18	103.5	10.6	9.7	7.3	29
7	10	96	1530	Cougar	2	5.2	20	103.5	10.2	9.5	7.2	26
7	10	96	1530	Cougar	2	5.2	22	103.5	9.9	9.5	7	25
7	10	96	1530	Cougar	2	5.2	24	103.5	9.8	9.6	7	25
7	10	96	1530	Cougar	2	5.2	26	103.5	9.5	9.7	6.9	26
7	10	96	1530	Cougar	2	5.2	28	103.5	9.3	10	6.9	27
7	10	96	1530	Cougar	2	5.2	30	103.5	9.1	10.1	6.9	28
7	10	96	1530	Cougar	2	5.2	32	103.5	9	10.2	6.8	27
7	10	96	1530	Cougar	2	5.2	34	103.5	8.9	10.3	6.8	27
7	10	96	1530	Cougar	2	5.2	36	103.5	8.7	10.4	6.8	27

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7	10	96	1530	Cougar	2	5.2	38	103.5	8.6	10.4	6.8	28
7	10	96	1530	Cougar	2	5.2	40	103.5	8.5	10.5	6.8	27
7	10	96	1530	Cougar	2	5.2	45	103.5	8.3	10.5	6.7	27
7	10	96	1530	Cougar	2	5.2	50	103.5	8.1	10.5	6.7	27
7	10	96	1530	Cougar	2	5.2	55	103.5	7.4	10.3	6.7	28
7	10	96	1530	Cougar	2	5.2	60	103.5	5.6	9.7	6.6	28
7	10	96	1530	Cougar	2	5.2	65	103.5	5.3	9.8	6.5	29
7	10	96	1530	Cougar	2	5.2	70	103.5	5.2	9.9	6.5	28
7	10	96	1530	Cougar	2	5.2	75	103.5	5.1	9.9	6.5	28
7	10	96	1530	Cougar	2	5.2	80	103.5	5	10	6.5	30
7	10	96	1530	Cougar	2	5.2	85	103.5	4.9	10	6.4	31
7	10	96	1530	Cougar	2	5.2	90	103.5	4.9	10	6.4	30
7	10	96	1530	Cougar	2	5.2	95	103.5	4.9	9.8	6.4	28
7	10	96	1530	Cougar	2	5.2	100	103.5	4.9	9.5	6.4	29
7	10	96	1625	Cougar	3	5.4	0	85	22.7	9.1	8.1	30
7	10	96	1625	Cougar	3	5.4	2	85	22.3	9.2	8.1	30
7	10	96	1625	Cougar	3	5.4	4	85	20.8	10	8.3	31
7	10	96	1625	Cougar	3	5.4	6	85	17.4	12.2	8.6	34
7	10	96	1625	Cougar	3	5.4	8	85	15.2	16.4	9.2	40
7	10	96	1625	Cougar	3	5.4	10	85	13.7	12	8.4	38
7	10	96	1625	Cougar	3	5.4	12	85	12.3	10.7	7.9	40
7	10	96	1625	Cougar	3	5.4	14	85	11.6	10.4	7.7	37
7	10	96	1625	Cougar	3	5.4	16	85	11.1	10.3	7.6	36
7	10	96	1625	Cougar	3	5.4	18	85	10.7	10.1	7.5	35
7	10	96	1625	Cougar	3	5.4	20	85	10.3	10	7.4	31
7	10	96	1625	Cougar	3	5.4	22	85	9.9	9.9	7.4	28
7	10	96	1625	Cougar	3	5.4	24	85	9.6	9.9	7.3	27
7	10	96	1625	Cougar	3	5.4	26	85	9.4	10	7.2	27
7	10	96	1625	Cougar	3	5.4	28	85	9.3	10.2	7.2	27
7	10	96	1625	Cougar	3	5.4	30	85	9.1	10.2	7.2	27
7	10	96	1625	Cougar	3	5.4	32	85	8.9	10.3	7.1	28
7	10	96	1625	Cougar	3	5.4	34	85	8.8	10.4	7.1	28
7	10	96	1625	Cougar	3	5.4	36	85	8.7	10.5	7.1	28
7	10	96	1625	Cougar	3	5.4	38	85	8.6	10.5	7	28
7	10	96	1625	Cougar	3	5.4	40	85	8.5	10.5	7	27
7	10	96	1625	Cougar	3	5.4	45	85	8.3	10.6	7	28
7	10	96	1625	Cougar	3	5.4	50	85	8.1	10.6	6.9	30
7	10	96	1625	Cougar	3	5.4	55	85	7.3	10	6.9	29
7	10	96	1625	Cougar	3	5.4	57.5	85	6.2	9.5	6.8	28
7	10	96	1625	Cougar	3	5.4	60	85	5.6	9.8	6.8	29
7	10	96	1625	Cougar	3	5.4	65	85	5.3	9.7	6.8	26
7	10	96	1625	Cougar	3	5.4	70	85	5.2	9.7	6.7	27
7	10	96	1625	Cougar	3	5.4	75	85	5.1	9.7	6.7	28
7	10	96	1625	Cougar	3	5.4	80	85	5.1	9.7	6.6	29
7	10	96	1625	Cougar	3	5.4	85	85	5	9.6	6.6	26
7	10	96	1700	Cougar	4	5.4	0	55.3	22.4	9.2	8.1	30

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7	10	96	1700	Cougar	4	5.4	2	55.3	21.9	9.3	8.2	30
7	10	96	1700	Cougar	4	5.4	4	55.3	21.3	9.5	8.2	31
7	10	96	1700	Cougar	4	5.4	6	55.3	17.7	10.6	8.1	36
7	10	96	1700	Cougar	4	5.4	8	55.3	15.9	11.1	8.3	39
7	10	96	1700	Cougar	4	5.4	10	55.3	13.7	10.2	7.8	43
7	10	96	1700	Cougar	4	5.4	12	55.3	12.5	10.2	7.6	43
7	10	96	1700	Cougar	4	5.4	14	55.3	11.6	10.3	7.5	40
7	10	96	1700	Cougar	4	5.4	16	55.3	11	10.3	7.4	39
7	10	96	1700	Cougar	4	5.4	18	55.3	10.6	10.2	7.4	37
7	10	96	1700	Cougar	4	5.4	20	55.3	10.2	10.1	7.3	33
7	10	96	1700	Cougar	4	5.4	22	55.3	9.9	10	7.2	34
7	10	96	1700	Cougar	4	5.4	24	55.3	9.6	9.9	7.1	28
7	10	96	1700	Cougar	4	5.4	26	55.3	9.4	10	7.1	29
7	10	96	1700	Cougar	4	5.4	28	55.3	9.2	9.9	7	29
7	10	96	1700	Cougar	4	5.4	30	55.3	9	9.9	7	29
7	10	96	1700	Cougar	4	5.4	32	55.3	8.9	10.2	7	29
7	10	96	1700	Cougar	4	5.4	34	55.3	8.8	10.3	6.9	30
7	10	96	1700	Cougar	4	5.4	36	55.3	8.7	10.2	6.9	30
7	10	96	1700	Cougar	4	5.4	38	55.3	8.6	10.2	6.9	29
7	10	96	1700	Cougar	4	5.4	40	55.3	8.5	10.1	6.9	29
7	10	96	1700	Cougar	4	5.4	45	55.3	8.2	9.9	6.8	30
7	10	96	1700	Cougar	4	5.4	50	55.3	8	10.1	6.8	29
7	10	96	1700	Cougar	4	5.4	52.5	55.3	7.7	9.5	6.7	29
7	10	96	1700	Cougar	4	5.4	55	55.3	6.5	9	6.7	30
8	27	96	1030	Cougar	1	5.5	0	107.3	21	8.7	8.2	36
8	27	96	1030	Cougar	1	5.5	2	107.3	21	8.7	8.1	36
8	27	96	1030	Cougar	1	5.5	4	107.3	21	8.7	8	36
8	27	96	1030	Cougar	1	5.5	6	107.3	20.1	11.1	8.4	37
8	27	96	1030	Cougar	1	5.5	8	107.3	18.6	12.2	8.5	39
8	27	96	1030	Cougar	1	5.5	10	107.3	16.6	12.7	8.7	41
8	27	96	1030	Cougar	1	5.5	12	107.3	15.7	11.5	8.4	40
8	27	96	1030	Cougar	1	5.5	14	107.3	15.1	10.4	7.9	40
8	27	96	1030	Cougar	1	5.5	16	107.3	14.6	9.6	7.6	42
8	27	96	1030	Cougar	1	5.5	18	107.3	14.1	9.1	7.4	42
8	27	96	1030	Cougar	1	5.5	20	107.3	13.6	8.8	7.2	40
8	27	96	1030	Cougar	1	5.5	22	107.3	12.7	8.5	7.1	38
8	27	96	1030	Cougar	1	5.5	24	107.3	12.2	8.3	7	36
8	27	96	1030	Cougar	1	5.5	26	107.3	11.7	8.6	7	34
8	27	96	1030	Cougar	1	5.5	28	107.3	11.2	8.5	6.9	34
8	27	96	1030	Cougar	1	5.5	30	107.3	10.8	8.3	6.9	30
8	27	96	1030	Cougar	1	5.5	32	107.3	10.5	8.2	6.8	30
8	27	96	1030	Cougar	1	5.5	34	107.3	10.3	8.4	6.8	29
8	27	96	1030	Cougar	1	5.5	36	107.3	10	8.7	6.7	29
8	27	96	1030	Cougar	1	5.5	38	107.3	9.8	8.8	6.7	29
8	27	96	1030	Cougar	1	5.5	40	107.3	9.4	9	6.7	29
8	27	96	1030	Cougar	1	5.5	42	107.3	9	9.1	6.7	29

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8	27	96	1030	Cougar	1	5.5	44	107.3	8.6	9.2	6.7	31
8	27	96	1030	Cougar	1	5.5	46	107.3	8	9.2	6.7	30
8	27	96	1030	Cougar	1	5.5	48	107.3	6.5	8.9	6.6	32
8	27	96	1030	Cougar	1	5.5	50	107.3	5.9	9.1	6.6	31
8	27	96	1030	Cougar	1	5.5	52	107.3	5.6	9.6	6.5	31
8	27	96	1030	Cougar	1	5.5	54	107.3	5	10	6.6	31
8	27	96	1030	Cougar	1	5.5	56	107.3	4.9	10.1	6.6	30
8	27	96	1030	Cougar	1	5.5	58	107.3	4.9	10	6.6	30
8	27	96	1030	Cougar	1	5.5	60	107.3	4.9	9.9	6.6	30
8	27	96	1030	Cougar	1	5.5	62	107.3	4.8	10	6.5	30
8	27	96	1030	Cougar	1	5.5	64	107.3	4.8	10	6.5	30
8	27	96	1030	Cougar	1	5.5	66	107.3	4.8	10	6.6	30
8	27	96	1030	Cougar	1	5.5	68	107.3	4.8	10.1	6.5	30
8	27	96	1030	Cougar	1	5.5	70	107.3	4.8	10.1	6.5	30
8	27	96	1030	Cougar	1	5.5	72	107.3	4.8	10.1	6.5	30
8	27	96	1030	Cougar	1	5.5	74	107.3	4.8	10	6.5	30
8	27	96	1030	Cougar	1	5.5	76	107.3	4.8	10	6.5	30
8	27	96	1030	Cougar	1	5.5	78	107.3	4.9	9.9	6.5	30
8	27	96	1030	Cougar	1	5.5	80	107.3	4.9	9.8	6.6	30
8	27	96	1030	Cougar	1	5.5	82	107.3	4.8	9.7	6.5	30
8	27	96	1030	Cougar	1	5.5	84	107.3	4.8	9.5	6.5	30
8	27	96	1030	Cougar	1	5.5	86	107.3	4.9	9.4	6.5	30
8	27	96	1030	Cougar	1	5.5	88	107.3	4.8	9.1	6.5	30
8	27	96	1030	Cougar	1	5.5	90	107.3	4.8	8.5	6.4	30
8	27	96	1030	Cougar	1	5.5	92	107.3	4.8	8.1	6.4	30
8	27	96	1030	Cougar	1	5.5	94	107.3	4.8	7.6	6.4	30
8	27	96	1030	Cougar	1	5.5	96	107.3	4.9	6.5	6.4	38
8	27	96	1030	Cougar	1	5.5	98	107.3	4.9	5.8	6.3	38
8	27	96	1030	Cougar	1	5.5	100	107.3	4.9	5.3	6.3	38
8	27	96	1030	Cougar	1	5.5	102	107.3	4.9	5.2	6.3	38
8	27	96	1030	Cougar	1	5.5	104	107.3	4.9	5	6.3	40
8	27	96	1030	Cougar	1	5.5	106	107.3	4.9	5.1	6.3	40
8	27	96	1030	Cougar	1	5.5	107	107.3	4.9	4.3	6.2	40
8	28	96	1115	Cougar	2	5.8	0	88.5	21	8.5	8.3	36
8	28	96	1115	Cougar	2	5.8	2	88.5	21	8.5	8.2	36
8	28	96	1115	Cougar	2	5.8	4	88.5	21	8.5	8.2	37
8	28	96	1115	Cougar	2	5.8	6	88.5	20.5	11	8.5	38
8	28	96	1115	Cougar	2	5.8	8	88.5	18.3	12.3	8.7	39
8	28	96	1115	Cougar	2	5.8	10	88.5	16.7	12.5	8.8	40
8	28	96	1115	Cougar	2	5.8	12	88.5	15.7	11.8	8.3	41
8	28	96	1115	Cougar	2	5.8	14	88.5	14.9	10.3	8	40
8	28	96	1115	Cougar	2	5.8	16	88.5	14.7	9.9	7.7	41
8	28	96	1115	Cougar	2	5.8	18	88.5	14.1	9.3	7.2	42
8	28	96	1115	Cougar	2	5.8	20	88.5	13.5	9	7.1	41
8	28	96	1115	Cougar	2	5.8	22	88.5	12.5	8.6	7	40
8	28	96	1115	Cougar	2	5.8	24	88.5	12.3	8.2	7	38

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8	28	96	1115	Cougar	2	5.8	26	88.5	11.7	8.3	6.9	37
8	28	96	1115	Cougar	2	5.8	28	88.5	11.1	8.3	7	36
8	28	96	1115	Cougar	2	5.8	30	88.5	10.9	8.2	6.9	34
8	28	96	1115	Cougar	2	5.8	32	88.5	10.7	8.2	6.9	31
8	28	96	1115	Cougar	2	5.8	34	88.5	10.4	8.3	6.8	30
8	28	96	1115	Cougar	2	5.8	36	88.5	10.1	8.5	6.8	29
8	28	96	1115	Cougar	2	5.8	38	88.5	9.9	8.8	6.7	29
8	28	96	1115	Cougar	2	5.8	40	88.5	9.6	9.1	6.8	29
8	28	96	1115	Cougar	2	5.8	42	88.5	9.1	9.1	6.7	28
8	28	96	1115	Cougar	2	5.8	44	88.5	8.6	9.2	6.7	30
8	28	96	1115	Cougar	2	5.8	46	88.5	8	9.2	6.7	31
8	28	96	1115	Cougar	2	5.8	48	88.5	6.6	9.1	6.7	31
8	28	96	1115	Cougar	2	5.8	50	88.5	6	9	6.8	31
8	28	96	1115	Cougar	2	5.8	55	88.5	5	10.1	6.7	30
8	28	96	1115	Cougar	2	5.8	60	88.5	4.9	10	6.6	30
8	28	96	1115	Cougar	2	5.8	65	88.5	4.9	10.1	6.5	30
8	28	96	1115	Cougar	2	5.8	70	88.5	4.9	9.7	6.5	32
8	28	96	1115	Cougar	2	5.8	75	88.5	4.8	7.1	6.4	33
8	28	96	1115	Cougar	2	5.8	80	88.5	4.8	6	6.4	35
8	28	96	1115	Cougar	2	5.8	85	88.5	4.9	5.2	6.3	38
8	28	96	1115	Cougar	2	5.8	88	88.5	4.9	5	6.2	38
8	28	96	1200	Cougar	3	5.5	0	72.1	21.2	8.7	8.2	37
8	28	96	1200	Cougar	3	5.5	2	72.1	21.2	8.8	8.2	37
8	28	96	1200	Cougar	3	5.5	4	72.1	21.1	8.8	8.2	36
8	28	96	1200	Cougar	3	5.5	6	72.1	20.7	10.9	8.6	37
8	28	96	1200	Cougar	3	5.5	8	72.1	18.7	11.7	8.7	37
8	28	96	1200	Cougar	3	5.5	10	72.1	17	12.5	8.7	39
8	28	96	1200	Cougar	3	5.5	12	72.1	15.9	11.8	8.5	40
8	28	96	1200	Cougar	3	5.5	14	72.1	15.3	10.7	8.1	41
8	28	96	1200	Cougar	3	5.5	16	72.1	15	9.8	7.7	41
8	28	96	1200	Cougar	3	5.5	18	72.1	14.3	9.2	7.5	42
8	28	96	1200	Cougar	3	5.5	20	72.1	13.6	8.8	7.3	41
8	28	96	1200	Cougar	3	5.5	22	72.1	12.8	8.6	7.1	40
8	28	96	1200	Cougar	3	5.5	24	72.1	12.2	8.4	7	37
8	28	96	1200	Cougar	3	5.5	26	72.1	11.6	8.4	7	35
8	28	96	1200	Cougar	3	5.5	28	72.1	11.1	8.3	7	34
8	28	96	1200	Cougar	3	5.5	30	72.1	10.8	8.3	7	31
8	28	96	1200	Cougar	3	5.5	32	72.1	10.6	8.2	6.8	30
8	28	96	1200	Cougar	3	5.5	34	72.1	10.3	8.3	6.9	30
8	28	96	1200	Cougar	3	5.5	36	72.1	10.1	8.5	6.8	29
8	28	96	1200	Cougar	3	5.5	38	72.1	9.9	8.9	6.8	29
8	28	96	1200	Cougar	3	5.5	40	72.1	9.5	8.9	6.7	30
8	28	96	1200	Cougar	3	5.5	42	72.1	9	9	6.7	29
8	28	96	1200	Cougar	3	5.5	44	72.1	8.8	9.1	6.7	29
8	28	96	1200	Cougar	3	5.5	46	72.1	8.1	9.3	6.6	30
8	28	96	1200	Cougar	3	5.5	48	72.1	6.7	9.7	6.6	30

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8	28	96	1200	Cougar	3	5.5	50	72.1	6	10	6.6	30
8	28	96	1200	Cougar	3	5.5	52	72.1	5.5	10.1	6.6	30
8	28	96	1200	Cougar	3	5.5	54	72.1	5	9.7	6.6	30
8	28	96	1200	Cougar	3	5.5	56	72.1	4.9	9.4	6.5	29
8	28	96	1200	Cougar	3	5.5	58	72.1	4.9	8.6	6.5	32
8	28	96	1200	Cougar	3	5.5	60	72.1	4.8	7	6.4	36
8	28	96	1200	Cougar	3	5.5	65	72.1	4.8	6.1	6.4	37
8	28	96	1200	Cougar	3	5.5	70	72.1	4.8	5.7	6.3	38
9	25	96	1000	Cougar	1	9.7	0	97.5	16.5	9.8	7.7	39
9	25	96	1000	Cougar	1	9.7	2	97.5	16.5	9.7	7.7	40
9	25	96	1000	Cougar	1	9.7	4	97.5	16.6	9.7	7.7	39
9	25	96	1000	Cougar	1	9.7	6	97.5	16.5	9.7	7.7	39
9	25	96	1000	Cougar	1	9.7	8	97.5	16.5	9.7	7.8	40
9	25	96	1000	Cougar	1	9.7	10	97.5	16.5	9.7	7.8	40
9	25	96	1000	Cougar	1	9.7	12	97.5	16.4	9.6	7.7	40
9	25	96	1000	Cougar	1	9.7	14	97.5	15.2	9.2	7.2	43
9	25	96	1000	Cougar	1	9.7	16	97.5	14.7	8.9	7.1	44
9	25	96	1000	Cougar	1	9.7	18	97.5	14.4	8.8	7	44
9	25	96	1000	Cougar	1	9.7	20	97.5	14.3	8.5	7	43
9	25	96	1000	Cougar	1	9.7	22	97.5	14.1	8.8	7	44
9	25	96	1000	Cougar	1	9.7	24	97.5	13.8	8.5	6.9	43
9	25	96	1000	Cougar	1	9.7	26	97.5	13.6	8.5	6.9	43
9	25	96	1000	Cougar	1	9.7	28	97.5	13.4	8.7	6.9	44
9	25	96	1000	Cougar	1	9.7	30	97.5	13.2	8.7	6.9	45
9	25	96	1000	Cougar	1	9.7	32	97.5	12.8	8.4	6.9	42
9	25	96	1000	Cougar	1	9.7	34	97.5	12.1	8.1	6.8	41
9	25	96	1000	Cougar	1	9.7	36	97.5	10	7.8	6.8	36
9	25	96	1000	Cougar	1	9.7	38	97.5	7.4	8.4	6.6	31
9	25	96	1000	Cougar	1	9.7	40	97.5	6.1	9.1	6.6	32
9	25	96	1000	Cougar	1	9.7	42	97.5	5.5	9.7	6.5	31
9	25	96	1000	Cougar	1	9.7	44	97.5	5.4	9.8	6.5	31
9	25	96	1000	Cougar	1	9.7	46	97.5	5.4	10	6.5	30
9	25	96	1000	Cougar	1	9.7	48	97.5	5.3	9.9	6.5	29
9	25	96	1000	Cougar	1	9.7	50	97.5	5.3	10	6.5	29
9	25	96	1000	Cougar	1	9.7	52	97.5	5.2	9.9	6.5	29
9	25	96	1000	Cougar	1	9.7	54	97.5	5.2	9.9	6.5	29
9	25	96	1000	Cougar	1	9.7	56	97.5	5.1	10	6.5	29
9	25	96	1000	Cougar	1	9.7	58	97.5	5.1	10	6.5	30
9	25	96	1000	Cougar	1	9.7	60	97.5	5.1	10.1	6.5	29
9	25	96	1000	Cougar	1	9.7	62	97.5	5	10.2	6.5	28
9	25	96	1000	Cougar	1	9.7	64	97.5	5	10	6.5	30
9	25	96	1000	Cougar	1	9.7	66	97.5	5	9.7	6.5	29
9	25	96	1000	Cougar	1	9.7	68	97.5	5	9.5	6.5	30
9	25	96	1000	Cougar	1	9.7	70	97.5	5	9.4	6.4	29
9	25	96	1000	Cougar	1	9.7	72	97.5	5	9.3	6.4	32
9	25	96	1000	Cougar	1	9.7	74	97.5	4.9	9.2	6.4	30

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9	25	96	1000	Cougar	1	9.7	76	97.5	4.9	9	6.4	30
9	25	96	1000	Cougar	1	9.7	78	97.5	4.9	8.8	6.4	31
9	25	96	1000	Cougar	1	9.7	80	97.5	4.9	8.5	6.4	32
9	25	96	1000	Cougar	1	9.7	82	97.5	4.9	8.1	6.4	32
9	25	96	1000	Cougar	1	9.7	84	97.5	4.9	7.6	6.3	31
9	25	96	1000	Cougar	1	9.7	86	97.5	4.9	7	6.3	36
9	25	96	1000	Cougar	1	9.7	88	97.5	4.9	6.2	6.3	38
9	25	96	1000	Cougar	1	9.7	90	97.5	4.9	5.2	6.3	39
9	25	96	1000	Cougar	1	9.7	92	97.5	4.9	4	6.3	40
9	25	96	1000	Cougar	1	9.7	94	97.5	5	2.7	6.3	45
9	25	96	1000	Cougar	1	9.7	96	97.5	5	2	6.3	51
9	25	96	1515	Cougar	2	9.2	0	84.3	17.5	10.1	7.5	39
9	25	96	1515	Cougar	2	9.2	2	84.3	16.8	10	7.6	39
9	25	96	1515	Cougar	2	9.2	4	84.3	16.7	9.9	7.6	39
9	25	96	1515	Cougar	2	9.2	6	84.3	16.7	9.8	7.6	40
9	25	96	1515	Cougar	2	9.2	8	84.3	16.6	9.8	7.6	41
9	25	96	1515	Cougar	2	9.2	10	84.3	16.6	9.8	7.6	40
9	25	96	1515	Cougar	2	9.2	12	84.3	15.3	9.4	7.4	45
9	25	96	1515	Cougar	2	9.2	14	84.3	15	9.2	7.3	44
9	25	96	1515	Cougar	2	9.2	16	84.3	14.8	9	7.2	44
9	25	96	1515	Cougar	2	9.2	18	84.3	14.5	9	7.1	45
9	25	96	1515	Cougar	2	9.2	20	84.3	14.1	9	7.1	45
9	25	96	1515	Cougar	2	9.2	22	84.3	14	9	7.1	46
9	25	96	1515	Cougar	2	9.2	24	84.3	13.8	9.1	7	45
9	25	96	1515	Cougar	2	9.2	26	84.3	13.5	9.2	7	45
9	25	96	1515	Cougar	2	9.2	28	84.3	13.4	9.3	7	44
9	25	96	1515	Cougar	2	9.2	30	84.3	13.2	9.2	7	46
9	25	96	1515	Cougar	2	9.2	32	84.3	12.9	9	7	46
9	25	96	1515	Cougar	2	9.2	34	84.3	12.3	8.5	6.9	43
9	25	96	1515	Cougar	2	9.2	36	84.3	10.6	8	6.9	38
9	25	96	1515	Cougar	2	9.2	38	84.3	7.4	8.1	6.8	31
9	25	96	1515	Cougar	2	9.2	40	84.3	6.1	8.5	6.5	33
9	25	96	1515	Cougar	2	9.2	42	84.3	5.8	8.6	6.5	31
9	25	96	1515	Cougar	2	9.2	44	84.3	5.6	8.8	6.5	31
9	25	96	1515	Cougar	2	9.2	46	84.3	5.5	9	6.4	31
9	25	96	1515	Cougar	2	9.2	48	84.3	5.4	9.2	6.4	32
9	25	96	1515	Cougar	2	9.2	50	84.3	5.3	9.2	6.4	29
9	25	96	1515	Cougar	2	9.2	52	84.3	5	9.3	6.4	35
9	25	96	1515	Cougar	2	9.2	54	84.3	5.1	9.3	6.4	32
9	25	96	1515	Cougar	2	9.2	56	84.3	4.9	9.4	6.4	32
9	25	96	1515	Cougar	2	9.2	58	84.3	4.9	9.5	6.4	33
9	25	96	1515	Cougar	2	9.2	60	84.3	4.8	9.5	6.4	34
9	25	96	1515	Cougar	2	9.2	62	84.3	4.8	9.5	6.4	33
9	25	96	1515	Cougar	2	9.2	64	84.3	4.8	9.4	6.4	33
9	25	96	1515	Cougar	2	9.2	66	84.3	4.7	9.3	6.3	32
9	25	96	1515	Cougar	2	9.2	68	84.3	4.7	9	6.3	32

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9	25	96	1515	Cougar	2	9.2	70	84.3	4.7	8.5	6.4	32
9	25	96	1515	Cougar	2	9.2	72	84.3	4.7	8.4	6.4	33
9	25	96	1515	Cougar	2	9.2	74	84.3	4.7	8.1	6.3	33
9	25	96	1515	Cougar	2	9.2	76	84.3	4.7	7.8	6.3	35
9	25	96	1515	Cougar	2	9.2	78	84.3	4.7	7	6.4	37
9	25	96	1515	Cougar	2	9.2	80	84.3	4.6	4.3	6.3	41
9	25	96	1515	Cougar	2	9.2	82	84.3	4.6	2.3	6.2	44
9	25	96	1550	Cougar	3	8.8	0	59	15.4	11.2	7.7	42
9	25	96	1550	Cougar	3	8.8	2	59	14.9	11	7.7	42
9	25	96	1550	Cougar	3	8.8	4	59	14.9	10.9	7.7	42
9	25	96	1550	Cougar	3	8.8	6	59	14.8	10.8	7.7	42
9	25	96	1550	Cougar	3	8.8	8	59	14.6	10.8	7.7	42
9	25	96	1550	Cougar	3	8.8	10	59	14.6	10.8	7.7	42
9	25	96	1550	Cougar	3	8.8	12	59	13.8	10.6	7.5	47
9	25	96	1550	Cougar	3	8.8	14	59	13.3	10.3	7.4	47
9	25	96	1550	Cougar	3	8.8	16	59	12.9	10.3	7.4	48
9	25	96	1550	Cougar	3	8.8	18	59	12.4	10.3	7.3	49
9	25	96	1550	Cougar	3	8.8	20	59	12.3	10.3	7.2	50
9	25	96	1550	Cougar	3	8.8	22	59	12	10.4	7.2	50
9	25	96	1550	Cougar	3	8.8	24	59	11.8	10.3	7.2	47
9	25	96	1550	Cougar	3	8.8	26	59	11.7	10.5	7.2	49
9	25	96	1550	Cougar	3	8.8	28	59	11.5	10.8	7.2	48
9	25	96	1550	Cougar	3	8.8	30	59	11.3	10.8	7.2	48
9	25	96	1550	Cougar	3	8.8	32	59	10.9	10.6	7.2	45
9	25	96	1550	Cougar	3	8.8	34	59	9.8	9.3	7.1	48
9	25	96	1550	Cougar	3	8.8	36	59	8.3	8.6	7	37
9	25	96	1550	Cougar	3	8.8	38	59	6.5	8.7	6.9	37
9	25	96	1550	Cougar	3	8.8	40	59	4.9	8.5	6.8	32
9	25	96	1550	Cougar	3	8.8	42	59	4.8	8.8	6.7	33
9	25	96	1550	Cougar	3	8.8	44	59	4.7	9	6.6	32
9	25	96	1550	Cougar	3	8.8	46	59	4.6	9.1	6.6	34
9	25	96	1550	Cougar	3	8.8	48	59	4.5	9.7	6.6	33
9	25	96	1550	Cougar	3	8.8	50	59	4.4	9.8	6.7	34
9	25	96	1550	Cougar	3	8.8	52	59	4.3	8.8	6.6	35
9	25	96	1550	Cougar	3	8.8	54	59	4.3	8	6.6	35
9	25	96	1550	Cougar	3	8.8	56	59	4.3	7.2	6.5	38
9	25	96	1550	Cougar	3	8.8	58	59	4.3	6	6.4	39
8	28	96	1140	Cougar	2	5.8	0	88.5	21	8.5	8.3	36
8	28	96	1140	Cougar	2	5.8	2	88.5	21	8.5	8.2	36
8	28	96	1140	Cougar	2	5.8	4	88.5	21	8.5	8.2	37
8	28	96	1140	Cougar	2	5.8	6	88.5	20.5	11	8.5	38
8	28	96	1140	Cougar	2	5.8	8	88.5	18.3	12.3	8.7	39
8	28	96	1140	Cougar	2	5.8	10	88.5	16.7	12.5	8.8	40
8	28	96	1140	Cougar	2	5.8	12	88.5	15.7	11.8	8.3	41
8	28	96	1140	Cougar	2	5.8	14	88.5	14.9	10.3	8	40
8	28	96	1140	Cougar	2	5.8	16	88.5	14.7	9.9	7.7	41

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8	28	96	1140	Cougar	2	5.8	18	88.5	14.1	9.3	7.2	42
8	28	96	1140	Cougar	2	5.8	20	88.5	13.5	9	7.1	41
8	28	96	1140	Cougar	2	5.8	22	88.5	12.5	8.6	7	40
8	28	96	1140	Cougar	2	5.8	24	88.5	12.3	8.2	7	38
8	28	96	1140	Cougar	2	5.8	26	88.5	11.7	8.3	6.9	37
8	28	96	1140	Cougar	2	5.8	28	88.5	11.1	8.3	7	36
8	28	96	1140	Cougar	2	5.8	30	88.5	10.9	8.2	6.9	34
8	28	96	1140	Cougar	2	5.8	32	88.5	10.7	8.2	6.9	31
8	28	96	1140	Cougar	2	5.8	34	88.5	10.4	8.3	6.8	30
8	28	96	1140	Cougar	2	5.8	36	88.5	10.1	8.5	6.8	29
8	28	96	1140	Cougar	2	5.8	38	88.5	9.9	8.8	6.7	29
8	28	96	1140	Cougar	2	5.8	40	88.5	9.6	9.1	6.8	29
8	28	96	1140	Cougar	2	5.8	42	88.5	9.1	9.1	6.7	28
8	28	96	1140	Cougar	2	5.8	44	88.5	8.6	9.2	6.7	30
8	28	96	1140	Cougar	2	5.8	46	88.5	8	9.2	6.7	31
8	28	96	1140	Cougar	2	5.8	48	88.5	6.6	9.1	6.7	31
8	28	96	1140	Cougar	2	5.8	50	88.5	6	9	6.8	31
8	28	96	1140	Cougar	2	5.8	55	88.5	5	10.1	6.7	30
8	28	96	1140	Cougar	2	5.8	60	88.5	4.9	10	6.6	30
8	28	96	1140	Cougar	2	5.8	65	88.5	4.9	10.1	6.5	30
8	28	96	1140	Cougar	2	5.8	70	88.5	4.9	9.7	6.5	32
8	28	96	1140	Cougar	2	5.8	75	88.5	4.8	7.1	6.4	33
8	28	96	1140	Cougar	2	5.8	80	88.5	4.8	6	6.4	35
8	28	96	1140	Cougar	2	5.8	85	88.5	4.9	5.2	6.3	38
8	28	96	1140	Cougar	2	5.8	88	88.5	4.9	5	6.2	38
8	28	96	1300	Cougar	3	5.5	0	72.1	21.2	8.7	8.2	37
8	28	96	1300	Cougar	3	5.5	2	72.1	21.2	8.8	8.2	37
8	28	96	1300	Cougar	3	5.5	4	72.1	21.1	8.8	8.2	36
8	28	96	1300	Cougar	3	5.5	6	72.1	20.7	10.9	8.6	37
8	28	96	1300	Cougar	3	5.5	8	72.1	18.7	11.7	8.7	37
8	28	96	1300	Cougar	3	5.5	10	72.1	17	12.5	8.7	39
8	28	96	1300	Cougar	3	5.5	12	72.1	15.9	11.8	8.5	40
8	28	96	1300	Cougar	3	5.5	14	72.1	15.3	10.7	8.1	41
8	28	96	1300	Cougar	3	5.5	16	72.1	15	9.8	7.7	41
8	28	96	1300	Cougar	3	5.5	18	72.1	14.3	9.2	7.5	42
8	28	96	1300	Cougar	3	5.5	20	72.1	13.6	8.8	7.3	41
8	28	96	1300	Cougar	3	5.5	22	72.1	12.8	8.6	7.1	40
8	28	96	1300	Cougar	3	5.5	24	72.1	12.2	8.4	7	37
8	28	96	1300	Cougar	3	5.5	26	72.1	11.6	8.4	7	35
8	28	96	1300	Cougar	3	5.5	28	72.1	11.1	8.3	7	34
8	28	96	1300	Cougar	3	5.5	30	72.1	10.8	8.3	7	31
8	28	96	1300	Cougar	3	5.5	32	72.1	10.6	8.2	6.8	30
8	28	96	1300	Cougar	3	5.5	34	72.1	10.3	8.3	6.9	30
8	28	96	1300	Cougar	3	5.5	36	72.1	10.1	8.5	6.8	29
8	28	96	1300	Cougar	3	5.5	38	72.1	9.9	8.9	6.8	29
8	28	96	1300	Cougar	3	5.5	40	72.1	9.5	8.9	6.7	30

Cougar & Blue River insitu data

8	28	96	1300	Cougar	3	5.5	42	72.1	9	9	6.7	29
8	28	96	1300	Cougar	3	5.5	44	72.1	8.8	9.1	6.7	29
8	28	96	1300	Cougar	3	5.5	46	72.1	8.1	9.3	6.6	30
8	28	96	1300	Cougar	3	5.5	48	72.1	6.7	9.7	6.6	30
8	28	96	1300	Cougar	3	5.5	50	72.1	6	10	6.6	30
8	28	96	1300	Cougar	3	5.5	52	72.1	5.5	10.1	6.6	30
8	28	96	1300	Cougar	3	5.5	54	72.1	5	9.7	6.6	30
8	28	96	1300	Cougar	3	5.5	56	72.1	4.9	9.4	6.5	29
8	28	96	1300	Cougar	3	5.5	58	72.1	4.9	8.6	6.5	32
8	28	96	1300	Cougar	3	5.5	60	72.1	4.8	7	6.4	36
8	28	96	1300	Cougar	3	5.5	65	72.1	4.8	6.1	6.4	37
8	28	96	1300	Cougar	3	5.5	70	72.1	4.8	5.7	6.3	38

Station	Month	Day	Year	Temp. (°C)	Diss. Ox.	pH	Conductivity
SF-IN	4	18	96	5.2	11.9	7.2	34
SF-OUT	4	18	96	5.8	12.3	7.2	31
MR-UP	4	18	96	6.1	12.5	7.3	42
LC	4	18	96	5.7	12	7.2	25
BR-IN	4	18	96	5.7	12.1	7.3	25
BR-OUT	4	18	96	6.4	12.3	7.2	24
MR-FR	4	18	96	7.4	12.1	7.3	38
MR-LD	4	18	96	7.3	12.2	7.3	36
MR-GS	4	18	96	7.3	12.1	7.3	36
MR-HB	4	18	96	8.2	11.7	7.3	38
SF-IN	5	27	96	10.2	11.4	7.1	33
SF-OUT	5	27	96	7.3	11.8	7.2	31
MR-UP	5	27	96	9.7	11.6	7	42
LC	5	27	96	9	11.6	7.7	27
BR-IN	5	27	96	9.2	11.6	7.6	27
BR-OUT	5	27	96	8.7	12.2	7	25
MR-FR	5	27	96	10.7	11.6	7.1	37
MR-LD	5	27	96	10	11.9	7	35
MR-GS	5	27	96	10.4	11.7	6.9	36
MR-HB	5	27	96	10.6	11.6	6.8	38
SF-IN	7	8	96	15.1	10.3	6.7	48
SF-OUT	7	8	96	9	11	7.3	28
MR-UP	7	8	96	14.1	10	7.5	48
LC	7	8	96	18.6	9.7	7.3	32
BR-IN	7	8	96	18.7	9.6	7.5	36
BR-OUT	7	8	96	9.4	11.4	7.5	26
MR-FR	7	8	96	15.3	10.2	7.5	46
MR-LD	7	8	96	13.5	10.5	7.6	46
MR-GS	7	8	96	15.6	10.2	7.5	46
MR-HB	7	8	96	17.8	9.6	7.5	47
SF-IN	8	26	96	9	11.5	7.3	50
SF-OUT	8	26	96	9.3	9.8	7.3	30
MR-UP	8	26	96	9.5	11.8	8.2	57
LC	8	26	96	14.6	9.9	7.6	36
BR-IN	8	26	96	15.2	10.2	7.5	44
BR-OUT	8	26	96	10	11.4	7.5	30
MR-FR	8	26	96	12.6	11.5	7.6	46
MR-LD	8	26	96	12.4	11.2	7.6	46
MR-GS	8	26	96	13.9	11.4	7.3	46
MR-HB	8	26	96	14.2	11.8	7.3	48
SF-IN	9	24	96	7.5	11.5	7.5	50
SF-OUT	9	24	96	12.5	9.1	7.3	42
MR-UP	9	24	96	8.6	11.8	7.3	53
LC	9	24	96	9.5	10.9	7.4	34
BR-IN	9	24	96	8.8	11	7.3	42
BR-OUT	9	24	96	9.7	11.3	7.3	28
MR-FR	9	24	96	10.8	11.2	7.5	46
MR-LD	9	24	96	14.3	9	7.5	40
MR-GS	9	24	96	12	11.4	7.7	47
MR-HB	9	24	96	13	11	7.6	48

APPENDIX B
CHEMISTRY DATA

Legend for data tables:

MO	= month sample collected
DAY	= day sample collected
YR	= year sample collected
STA	= station or lake for sample
DEP	= depth or other station descriptor
IN	= station descriptor denoting inflow to the lake
OUT	= station descriptor denoting outflow from dam
UP	= station descriptor denoting upstream position from confluence of dam outflows
FR	= station descriptor denoting Finn Rock Bridge over McKenzie River
LD	= station descriptor denoting Leaburg Dam on McKenzie River
GS	= station descriptor denoting a USGS gaging station just downstream from the exit of Waltherville canal
HB	= station descriptor denoting the water intake on the McKenzie River at Hayden Bridge
TP	= total phosphorus (unfiltered and digested)
TSP	= total soluble phosphorus (filtered and digested)
TN	= total nitrogen (unfiltered and digested)
TSN	= total soluble nitrogen (filtered and digested)
NH3	= ammonia in undigested water
SRP	= soluble reactive phosphorus (filtered and undigested)
SO4	= dissolved sulfate (filtered and undigested)
TOC	= total organic carbon (unfiltered and inorganic removed)
DOC	= dissolved organic carbon (filtered and inorganic removed)
TMN	= total manganese (unfiltered and digested)
TFE	= total iron (unfiltered and digested)
DMn	= dissolved manganese (filtered and digested)
DFe	= dissolved iron (filtered and digested)
TALK	= total alkalinity (milli-equivalents)
TURB	= turbidity (NTU)
ND	= not detected
-0.05	= below detection limit = ND
-9	= sample lost in preparation for analysis

Note: all values for measured concentrations are in units of mg/liter (parts per million) unless otherwise noted above. (See TURB and TALK.)

WATER CHEMISTRY, APRIL 1996 SUMMARY

MO	YR	DAY	STA	DEP	TP	TSP	TN	TSN	NH3	N03	SRP	SO4	TOC	DOC	TMN	DMn	TFe	DFe	TALK
4	96	16	BR	0	0.019	0.012	0.164	0.107	ND	0.004	0.008	0.697	1.00	1.10	-0.050	-0.050	0.133	-0.050	11.8
4	96	16	BR	6	0.017	0.013	0.091	0.136	ND	0.001	0.008	0.839	1.21	1.15	-0.050	-0.050	0.111	-0.050	12.0
4	96	16	BR	10	0.017	0.015	0.133	0.129	ND	0.004	0.007	0.899	1.24	1.16	-0.050	-0.050	0.144	-0.050	11.8
4	96	16	BR	20	0.019	0.014	0.086	0.114	ND	0.001	0.009	0.711	1.20	0.88	-0.050	-0.050	0.200	-0.050	9.0
4	96	16	BR	30	0.021	0.015	0.100	0.129	ND	0.002	0.011	0.662	1.18	0.89	-0.050	-0.050	0.255	-0.050	11.8
4	96	16	BR	40	0.026	0.014	0.088	0.124	ND	0.006	0.011	0.716	1.25	1.15	-0.050	-0.050	0.599	-0.050	11.5
4	96	16	BR	50	0.029	0.019	0.107	0.110	ND	0.008	0.010	0.689	1.67	1.23	-0.050	-0.050	0.622	-0.050	11.5
4	96	17	CR	0	0.016	0.011	0.088	0.093	ND	0.004	0.010	0.332	1.25	0.97	-0.050	-0.050	0.056	-0.050	14.0
4	96	17	CR	10	0.017	0.011	0.079	0.119	ND	0.001	0.009	0.237	1.14	0.91	-0.050	-0.050	0.078	-0.050	13.5
4	96	17	CR	20	0.018	0.013	0.110	0.121	ND	0.001	0.011	0.241	1.02	0.96	-0.050	-0.050	0.100	-0.050	14.8
4	96	17	CR	30	0.017	0.014	0.055	0.100	ND	0.001	0.012	0.254	1.02	1.06	-0.050	-0.050	0.078	-0.050	14.5
4	96	17	CR	40	0.019	0.016	0.129	0.110	ND	0.008	0.014	0.233	1.03	1.05	-0.050	-0.050	0.078	-0.050	15.8
4	96	17	CR	50	0.024	0.017	0.105	0.152	ND	0.019	0.013	0.264	1.34	1.23	-0.050	-0.050	0.244	-0.050	15.5
4	96	17	CR	60	0.026	0.018	0.112	0.159	ND	0.019	0.013	0.243	1.41	1.33	-0.050	-0.050	0.344	0.050	15.5
4	96	17	CR	70	0.028	0.017	0.110	0.103	ND	0.022	0.014	0.255	1.36	1.33	-0.050	-0.050	0.433	-0.050	15.3
4	96	17	CR	80	0.030	0.017	0.095	0.121	ND	0.023	0.013	0.248	1.43	1.42	-0.050	-0.050	0.566	-0.050	15.0
4	96	17	CR	90	0.032	0.018	0.114	0.124	ND	0.026	0.013	0.256	1.52	1.47	-0.050	-0.050	0.660	0.060	14.8
4	96	17	CR	100	0.032	0.016	0.143	0.133	ND	0.028	0.013	0.265	1.60	1.47	-0.050	-0.050	0.730	0.070	16.5
4	96	18	LC	IN	0.014	0.015	0.199	0.214	0.015	0.011	0.014	0.332	1.15	1.41	-0.050	-0.050	0.089	-0.050	12.5
4	96	18	BR	IN	0.018	0.017	0.209	0.214	0.036	0.006	0.015	0.714	1.56	1.58	-0.050	-0.050	0.122	-0.050	12.2
4	96	18	BR	OUT	0.026	0.015	0.202	0.237	0.027	0.009	0.010	0.738	1.56	1.60	-0.050	-0.050	0.500	-0.050	11.5
4	96	18	SF	IN	0.023	0.025	0.225	0.256	0.030	0.010	0.020	0.253	1.31	1.46	-0.050	-0.050	0.056	-0.050	16.0
4	96	18	SF	OUT	0.019	0.015	0.157	0.214	0.020	0.015	0.013	0.359	1.27	1.23	-0.050	-0.050	0.211	-0.050	15.0
4	96	18	MR	UP	0.036	0.033	0.195	0.133	0.008	0.004	0.030	0.670	0.80	0.81	-0.050	-0.050	0.089	-0.050	19.8
4	96	18	MR	FR	0.042	0.036	0.188	0.249	0.032	0.008	0.024	0.618	1.52	1.58	-0.050	-0.050	0.122	-0.050	18.5
4	96	18	MR	LD	0.030	0.027	0.169	0.214	0.020	0.012	0.021	0.685	1.10	1.16	-0.050	-0.050	0.144	-0.050	17.0
4	96	18	MR	GS	0.029	0.023	0.202	0.145	0.012	0.008	0.020	0.644	0.97	1.09	-0.050	-0.050	0.144	-0.050	17.8
4	96	18	MR	HB	0.029	0.022	0.225	0.155	0.018	0.012	0.019	0.709	1.05	1.27	-0.050	-0.050	0.167	-0.050	19.0

WATER CHEMISTRY, MAY 1996 SUMMARY

MO	DAY	YR	STA	DEP	TP	TSP	TN	TSN	NH3	N03	SRP	SO4	TOC	DOC	TMN	DMn	TFe	DFe	TALK	TURB
5	28	96	BR 0	0	0.012	0.003	0.350	0.286	-0.020	0.000	0.004	0.804	1.27	5.76	-0.05	-0.05	0.12	-0.05	12.4	1.60
5	28	96	BR 6	6	0.008	0.003	0.358	0.310	-0.020	0.001	0.004	1.014	1.42	1.78	-0.05	-0.05	0.11	-0.05	12.6	1.70
5	28	96	BR 6	6															13.0	
5	28	96	BR 10	10	0.008	0.003	0.374	0.227	-0.020	0.001	0.004	0.982	1.44	3.30	-0.05	-0.05	0.11	-0.05	12.7	1.50
5	28	96	BR 20	20	0.016	0.010	0.275	0.210	-0.020	0.001	0.011	0.757	1.45	1.12	-0.05	-0.05	0.16	-0.05	12.1	2.00
5	28	96	BR 20	20						0.002	0.010	0.750								
5	28	96	BR 30	30	0.016	0.011	0.214	0.280	-0.020	0.001	0.011	0.857	1.10	0.98	-0.05	-0.05	0.16	-0.05	11.8	2.30
5	28	96	BR 40	40	0.018	0.011	0.201	0.345	-0.020	0.001	0.012	0.781	1.04	1.08	-0.05	-0.05	0.20	-0.05	11.4	3.30
5	28	96	BR 50	50	0.022	0.012	0.175	0.267	-0.020	0.002	0.012	0.621	3.14	1.20	-0.05	-0.05	0.32	-0.05	12.1	4.40
5	28	96	BR 50	50															12.4	
5	28	96	BR 60	60	0.031	0.017	0.263	0.265	-0.020	0.000	0.012	0.597	1.08	1.03	-0.05	-0.05	0.68	-0.05	11.5	8.60
5	28	96	BR 60	60						0.002	0.012	0.604								
5	28	96	BR 60	60						0.000	0.011	0.586								
5	29	96	CR 0	0	0.013	0.005	0.376	0.284	-0.020	0.001	0.001	0.217	5.77	2.18	-0.05	-0.05	0.13	-0.05	15.5	3.00
5	29	96	CR 6	6	0.012	0.003	0.295	0.339	-0.020	0.001	0.001	0.242	1.69	1.60	-9	-9	0.11	-0.05	11.7	1.80
5	29	96	CR 10	10	0.009	0.003	0.314	0.122	-0.020	0.004	0.002	0.241	1.34	1.20	-0.05	-0.05	0.12	-0.05	13.2	1.30
5	29	96	CR 10	10						0.005	0.000	0.259								
5	29	96	CR 20	20	0.015	0.011	0.214	0.250	-0.020	0.001	0.007	0.247	1.10	1.05	-0.05	-0.05	0.09	-0.05	14.3	0.50
5	29	96	CR 30	30	0.012	0.011	0.472	0.199	-0.020	0.004	0.007	0.273	4.98	3.54	-0.05	-0.05	0.07	-0.05	12.3	0.60
5	29	96	CR 40	40	0.016	0.014	0.214	0.083	-0.020	0.003	0.010	0.252	1.40	1.26	-0.05	-0.05	0.07	-0.05	15.2	0.50
5	29	96	CR 50	50	0.018	0.016	0.210	0.157	-0.020	0.005	0.010	0.265	1.05	1.26	-0.05	-0.05	0.11	-0.05	14.6	1.20
5	29	96	CR 60	60	0.022	0.016	0.170	0.166	-0.020	0.018	0.012	0.281	3.87	2.35	-0.05	-0.05	0.33	0.05	16.6	4.90
5	29	96	CR 60	60															16.1	
5	29	96	CR 70	70	0.024	0.017	0.170	0.194	-0.020	0.020	0.013	0.275	1.55	1.49	-0.05	-0.05	0.42	-0.05	15.7	5.90
5	29	96	CR 80	80	0.016	0.015	0.179	0.148	-0.020	0.022	0.011	0.281	1.68	1.34	-0.05	-0.05	0.53	0.08	15.4	7.50
5	29	96	CR 90	90	0.030	0.015	0.188	0.157	-0.020	0.025	0.010	0.289	5.31	2.84	-0.05	-0.05	0.73	0.14	15.6	8.40
5	29	96	CR 100	100	0.039	0.015	0.192	0.205	-0.020	0.031	0.009	0.331	1.54	1.44	-0.05	-0.05	0.61	0.05	16.7	9.60
5	27	96	CR 110	110	0.029	0.017	0.321	0.223	-0.020	0.034	0.012	0.372	1.64	1.54	0.08	-0.05	0.61	0.11	17.2	10.30
5	27	96	LC LC	LC	0.018	0.016	0.252	0.284	-0.020	0.005	0.018	0.498	0.74	0.65	-0.05	-0.05	0.09	-0.05	13.1	0.60
5	27	96	BR IN	IN	0.019	0.020	0.239	0.376	-0.020	0.004	0.017	0.871	0.60	0.74	-0.05	-0.05	0.12	-0.05	13.4	0.60
5	27	96	BR OUT	OUT	0.022	0.013	0.299	0.284	-0.020	0.002	0.012	0.579	1.56	1.41	-0.05	-0.05	0.40	-0.05	12.1	4.70
5	27	96	SF IN	IN	0.020	0.021	0.332	0.249	-0.020	0.001	0.017	0.193	0.32	0.47	-0.05	-0.05	0.08	-0.05	17.3	0.40
5	27	96	SF OUT	OUT	0.019	0.016	0.264	0.245	-0.020	0.006	0.013	0.282	1.27	1.27	-0.05	-0.05	0.11	-0.05	15.1	1.40
5	27	96	MR UP	UP	0.035	0.033	0.262	0.179	-0.020	0.002	0.030	0.611	0.20	0.21	-0.05	-0.05	0.10	-0.05	19.6	0.30
5	27	96	MR FR	FR	0.029	0.026	0.180	0.223	-0.020	0.001	0.021	0.535	0.98	0.76	-0.05	-0.05	0.12	-0.05	18.0	2.00
5	27	96	MR LD	LD	0.026	0.024	0.166	0.232	-0.020	0.004	0.018	0.568	1.33	1.06	-0.05	-0.05	0.10	-0.05	17	1.40
5	27	96	MR GS	GS	0.024	0.024	0.378	0.212	-0.020	0.007	0.019	0.555	0.65	0.41	-0.05	-0.05	0.12	-0.05	17	1.30
5	27	96	MR HB	HB	0.025	0.022	0.621	0.492	-0.020	0.016	0.009	0.591	0.78	0.68	-0.05	-0.05	0.21	-0.05	19	1.50

WATER CHEMISTRY, JULY 1996 SUMMARY

MO	DAY	YR	STA	DEP	K	P	Mg	Ca	TP	TSP	TN	TSN	NH3	N03	SRP	SO4	TOC	DOC	TMN	DMn	TFe	DFe	TALK	TURB
7	23	96	BR	0									0.000				1.92	1.71	-0.05	-0.05	0.06	-0.05	12.5	0.7
7	23	96	BR	7.5									0.000				1.91	1.61	-0.05	-0.05			15.3	1.25
7	23	96	BR	10									0.004				2.13	2.17	-0.05	-0.05			12.5	1.6
7	23	96	BR	20									0.000				1.60	1.45	-0.05	-0.05			12.3	1
7	23	96	BR	30									0.009				1.37	1.38	-0.05	-0.05			11.5	1.3
7	23	96	BR	40									0.014				1.22	1.46	-0.05	-0.05			13.3	2.3
7	23	96	BR	50									0.015				1.40	1.25	-0.05	-0.05			12.0	3.2
7	23	96	BR	60									0.020				1.29	1.35	-0.05	-0.05			11.5	4.7
7	23	96	CR	0	2.14	0.53	1.14	3.17	0.009	0.007	0.141	0.165	0.009	0.004	0.006	0.356	1.39	1.50	-0.05	-0.05	0.06	-0.05	13.8	1
7	23	96	CR	6	2.18	0.58	1.23	3.37	0.010	0.008	0.199	0.166	0.019	0.003	0.001	0.200	1.42	1.26	-0.05	-0.05		-9		-9
7	23	96	CR	10	2.11	0.62	1.29	3.45	0.010	0.007	0.219	0.187	0.025	0.002	0.001	0.119	1.58	1.40	-0.05	-0.05	0.08	-0.05	16.8	1.5
7	23	96	CR	20	1.91	0.49	1.02	2.94	0.007	0.007	0.148	0.172	0.028	0.009	0.001	0.252	1.29	1.24	-0.05	-0.05	0.10	-0.05	13.3	0.6
7	23	96	CR	30	1.77	0.49	1.01	2.85	0.011	0.012	0.158	0.195	0.046	0.013	0.006	0.268	1.28	1.22	-0.05	-0.05	0.08	-0.05	14.3	0.5
7	23	96	CR	40	1.92	0.51	1.09	3.04	0.017	0.016	0.187	0.187	0.033	0.007	0.013	0.250	1.28	1.24	-0.05	-0.05	0.08	-0.05	14.3	0.5
7	23	96	CR	50	1.91	0.52	1.10	3.06	0.018	0.017	0.141	0.117	0.022	0.009	0.013	0.248	1.25	1.22	-0.05	-0.05	0.24	-0.05	14.5	0.6
7	23	96	CR	60	1.97	0.53	1.23	3.37	0.021	0.017	0.134	0.212	0.007	0.038	0.013	0.264	1.28	1.40	-0.05	-0.05	0.34	0.05	14.5	2.7
7	23	96	CR	70	2.00	0.52	1.23	3.37	0.023	0.018	0.124	0.151	0.013	0.035	0.013	0.279	1.33	1.32	-0.05	-0.05	0.43	-0.05	15.3	3.6
7	23	96	CR	80	2.00	0.53	1.22	3.37	0.023	0.017	0.144	0.148	0.007	0.033	0.012	0.276	1.62	2.93	-0.05	-0.05	0.57	-0.05	15.3	4.2
7	23	96	CR	90	2.02	0.51	1.21	3.34	0.022	0.017	0.124	0.158	0.005	0.036	0.014	0.291	1.56	1.50	-0.05	-0.05	0.66	0.06	14.3	4.9
7	23	96	CR	100	2.14	0.50	1.21	3.41	0.024	0.017	0.134	0.151	0.007	0.049	0.035	0.379	1.43	-0.12	-0.05	-0.05	0.73	0.07	15.0	6.2
7	23	96	CR	110	2.21	0.50	1.22	3.45	0.027	0.018	0.160	0.180	0.007	0.052	0.051	0.391	1.46	1.42	-0.05	-0.05	0.73	0.07	15.5	9.5
7	9	96	LC	LC	2.35	0.57	1.09	3.31	0.023	0.021	0.231	0.299	0.000	0.003	0.022	0.359	1.54	1.46	-0.05	-0.05	0.10	-0.05	16.5	-9
7	9	96	BR	IN	2.65	0.35	1.00	4.12	0.021	0.020	0.304	0.271	0.003	0.003	0.018	1.486	1.51	3.71	-0.05	-0.05	0.10	-0.05	15.5	-9
7	9	96	BR	OUT	1.85	0.30	0.80	3.14	0.030	0.023	0.397	0.366	0.023				2.74	2.21	-0.05	-0.05	0.57	-0.05	12.8	-9
7	9	96	SF	IN	2.71	1.10	1.85	4.68	0.037	0.036	0.304	0.287	0.005	0.011	0.039	0.816	-9	2.78	-0.05	-0.05	0.10	-0.05	24.5	-9
7	9	96	SF	OUT	2.04	0.55	1.09	3.05	0.018	0.061	0.366	0.534	0.015	0.015	0.016	0.308	1.75	1.95	-0.05	-0.05	0.18	-0.05	14.0	-9
7	9	96	MR	UP	4.20	1.15	2.02	4.03	0.063	0.060	0.226	0.313	0.000	0.004	0.047	0.923	2.21	1.92	-0.05	-0.05	0.09	-0.05	24.3	0.8
7	9	96	MR	FR	3.75	1.06	1.82	3.76	0.061	0.057	0.310	0.287	0.000				2.21	2.11	-0.05	-0.05	0.07	-0.05	22.8	1.8
7	9	96	MKRLD		3.76	0.93	1.81	3.82	0.043	0.042	0.271	0.287	0.000	0.005	0.036	0.846	1.77	1.59	-0.05	-0.05	0.14	-0.05	22.5	1.1
7	9	96	MKRGs		3.71	0.94	1.84	4.02	0.039	0.037	0.287	0.372	0.000	0.006	0.033	0.821	8.04	1.72	-0.05	-0.05	0.13	-0.05	21.5	0.7
7	9	96	MKRHB		3.65	0.92	1.83	3.95	0.039	0.034	0.304	0.315	0.000	0.004	0.029	0.765	5.49	1.77	-0.05	-0.05	0.18	-0.05	22.5	0.75

7	10	96	CR	0	0.006	0.006	0.304	0.372	0.002	0.002	0.552	-0.05	-0.05	0.12	-0.05	
7	10	96	CR	10	0.007	0.006	0.439	0.416	0.001	0.000	0.241	-0.05	-0.05	0.08	-0.05	
7	10	96	CR	20	0.006	0.004	0.344	0.271	0.006	0.001	0.235	-0.05	-0.05	0.11	-0.05	
7	10	96	CR	30	0.006	0.005	0.315	0.287	0.001	0.001	0.251	-0.05	-0.05	0.10	-0.05	
7	10	96	CR	30	0.006	0.004	0.338	0.271	0.000	0.000	0.233	-0.05	-0.05	0.08	-0.05	
7	10	96	CR	40	0.008	0.009	0.287	0.254	0.001	0.003	0.298	-0.05	-0.05	0.19	-0.05	
7	10	96	CR	50	0.012	0.007	0.287	0.220	0.001	0.002	0.238	-0.05	-0.05	0.32	-0.05	
7	10	96	CR	60	0.012	0.006	0.254	0.254	0.000	0.001	0.271	-0.05	-0.05	0.34	-0.05	
7	10	96	CR	70	0.016	0.006	0.299	0.332	0.001	0.000	0.287	-0.05	-0.05	0.38	-0.05	
7	10	96	CR	80	0.012	0.009	0.310	0.282	0.000	0.003	0.259	-0.05	-0.05	0.34	-0.05	
7	10	96	CR	90	0.019	0.006	0.296	0.358	0.000	0.001	0.288	-0.05	-0.05	0.41	-0.05	
7	10	96	CR	100	0.020	0.011	0.293	0.251	0.000	0.000	0.293	-0.05	-0.05	0.78	0.07	
7	10	96	CR	110	0.018	0.010	0.248	0.299	0.000	0.000	0.320	-0.05	-0.05	0.14	-0.05	
7	9	96	BR	0	3.24	0.007	0.005	0.366	0.372	0.002	0.003	0.867	-0.05	-0.05	0.09	-0.05
7	9	96	BR	7.5	3.37	0.010	0.005	0.467	0.478	0.002	0.002	0.982	-0.05	-0.05	0.08	-0.05
7	9	96	BR	10	3.33	0.010	0.009	0.450	0.405	0.007	0.002	0.944	-0.05	-0.05	0.14	-0.05
7	9	96	BR	20	3.22	0.010	0.008	0.369	0.405	0.011	0.004	0.858	-0.05	-0.05	0.20	-0.05
7	9	96	BR	30	3.10	0.016	0.012	0.416	0.352	0.014	0.010	0.813	-0.05	-0.05	0.29	-0.05
7	9	96	BR	40	3.18	0.017	0.012	0.338	0.383	0.016	0.010	0.769	-0.05	-0.05	0.38	-0.05
7	9	96	BR	50	3.16	0.020	0.012	0.254	0.360	0.016	0.009	0.737	-0.05	-0.05	0.6	-0.05
7	9	96	BR	60	3.08	0.020	0.012	0.346	0.372	0.016	0.009	0.714	-0.05	-0.05		

WATER CHEMISTRY, AUGUST 1996 SUMMARY

MO	DAY	YR	STA	DEP	K	P	Mg	Ca	TP	TSP	TN	TSN	NH3	N03	SRP	SO4	TOC	DOC	TMN	DMn	TFe	DFe	TALK	TURB
8	26	96	BR	0	2.14	0.31	0.89	3.33	0.008	0.004	0.163	0.141	0.005	0.000	0.006	0.946	1.82	1.80	-0.05	-0.05	0.13	-0.05	12.50	0.60
8	26	96	BR	10	2.09	0.31	0.88	3.35	0.008	0.004	0.170	0.185	0.013	0.005	0.005	0.987	1.78	1.64	-0.05	-0.05	0.14	-0.05	12.00	0.60
8	26	96	BR	20	1.74	0.25	0.81	3.61	0.006	0.004	0.196	0.252	0.007	0.021	0.000	1.081	1.51	1.48	-0.05	-0.05	0.20	-0.05	12.00	0.40
8	26	96	BR	30	1.83	0.25	0.77	3.09	0.010	0.008	0.199	0.152	0.007	0.028	0.004	0.817	1.57	1.42	-0.05	-0.05	0.26	-0.05	10.00	1.10
8	26	96	BR	40	1.82	0.26	0.82	3.30	0.015	0.011	0.190	0.207	0.004	0.053	0.008	0.780	1.46	1.44	-0.05	-0.05	0.60	-0.05	11.00	1.20
8	26	96	BR	50	1.84	0.27	0.85	3.30	0.016	0.012	0.176	0.161	0.007	0.060	0.009	0.722	1.50	1.38	-0.05	-0.05	0.62	-0.05	11.50	1.70
8	26	96	BR	60	1.87	0.29	0.88	3.39	0.020	0.010	0.472	0.203	0.007	0.062	0.009	0.679	1.49	1.46	-0.05	-0.05	0.62	-0.05	11.00	4.00
8	28	96	CR	0	2.35	0.64	1.30	3.48	0.008	0.005	0.196	0.166	0.017	0.001	0.000	0.435	0.66	0.61	-0.05	-0.05	0.06	-0.05	17.00	0.74
8	28	96	CR	6	2.34	0.68	1.37	3.61	0.008	0.004	0.145	0.240	0.012	0.002	0.000	0.411	0.62	0.54	-0.05	-0.05	0.06	-0.05	17.00	0.84
8	28	96	CR	10	2.36	0.77	1.52	3.94	0.008	0.004	0.174	0.234	0.011	0.002	0.001	0.401	0.57	0.54	-0.05	-0.05	0.08	-0.05	18.50	0.94
8	28	96	CR	20	2.29	0.75	1.50	3.98	0.009	0.004	0.260	0.194	0.040	0.013	0.001	0.494	0.34	0.23	-0.05	-0.05	0.10	-0.05	16.50	0.78
8	28	96	CR	30	1.91	0.55	1.14	3.21	0.012	0.008	0.227	0.333	0.056	0.015	0.007	0.573	0.61	0.46	-0.05	-0.05	0.08	-0.05	11.50	0.80
8	28	96	CR	40	1.95	2.99	1.16	3.13	0.017	0.013	0.269	0.214	0.008	0.050	0.011	0.559	0.64	0.76	-0.05	-0.05	0.08	-0.05	12.00	0.64
8	28	96	CR	50	1.88	0.52	1.25	3.35	0.019	0.016	0.251	0.214	0.010	0.053	0.014	0.595	0.53	0.74	-0.05	-0.05	0.24	-0.05	13.00	2.30
8	28	96	CR	60	1.90	0.53	1.24	3.37	0.019	0.019	0.165	0.216	0.010	0.043	0.013	0.589	1.24	0.63	-0.05	-0.05	0.34	0.05	12.50	3.20
8	28	96	CR	70	2.00	4.89	1.29	3.40	0.022	0.017	0.194	0.177	0.008	0.041	0.014	0.619	0.67	0.71	-0.05	-0.05	0.34	0.05	13.00	3.50
8	28	96	CR	80	1.98	0.51	1.23	3.41	0.022	0.017	0.188	0.123	0.005	0.046	0.014	0.667	0.66	0.74	-0.05	-0.05	0.57	-0.05	13.00	4.20
8	28	96	CR	90	2.11	0.51	1.30	3.69	0.025	0.018	0.240	0.232	0.008	0.078	0.010	0.719	8.35	0.86	-0.05	-0.05	0.66	0.06	15.00	4.80
8	28	96	CR	100	3.12	0.52	1.47	4.42	0.034	0.016	0.199	0.256	0.030	0.106	0.005	0.950	1.73	0.76	-0.05	-0.05	0.73	0.07	16.00	8.00
8	28	96	LC	LC	2.57	0.57	1.20	3.64	0.023	0.020	0.130	0.086	0.007	0.006	0.018	0.555	0.52	0.49	-0.05	-0.05	0.14	-0.05	15.50	0.94
8	28	96	BR	IN	3.11	0.32	1.14	4.65	0.017	0.017	0.108	0.141	0.011	0.003	0.019	4.964	0.59	0.54	-0.05	-0.05	0.12	-0.05	14.75	0.22
8	28	96	BR	OUT	2.11	0.29	0.95	4.06	0.023	0.011	0.483	0.216	0.012	0.053	0.008	1.538	0.65	0.65	-0.05	-0.05	0.12	-0.05	13.50	2.60
8	28	96	SF	IN	3.08	1.15	2.00	4.89	0.039	0.039	0.108	0.141	0.007	0.002	0.038	0.406	-0.12	-0.19	-0.05	-0.05	0.21	-0.05	22.75	0.16
8	28	96	CR	OUT	2.02	0.53	1.16	3.18	0.017	0.013	0.199	0.121	0.014	0.043	0.012	0.525	0.67	0.60	-0.05	-0.05	0.21	-0.05	13.50	0.63
8	28	96	MR	UP	4.56	1.16	2.15	4.14	0.053	0.051	0.179	0.115	0.007	0.003	0.049	2.044	-0.12	-0.16	-0.05	-0.05	0.06	-0.05	23.50	0.36
8	28	96	MR	FR	3.58	1.97	1.78	3.79	0.042	0.037	0.170	0.090	0.008	0.012	0.033	1.467	0.60	0.30	-0.05	-0.05	0.09	-0.05	19.25	0.50
8	28	96	MR	LD	3.63	0.93	1.78	3.82	0.044	0.037	0.126	0.245	0.008	0.007	0.031	1.501	0.31	0.35	-0.05	-0.05	0.09	-0.05	19.75	0.48
8	28	96	MR	GS	3.58	0.89	1.77	3.82	0.036	0.034	0.368	0.137	0.011	0.008	0.030	1.611	2.83		-0.05	-0.05	0.17	-0.05	20.00	0.40
8	28	96	MR	HB	3.65	0.90	1.81	3.91	0.034	0.031	0.256	0.099	0.014	0.007	0.022	2.395	2.43	0.22	-0.05	-0.05	0.12	-0.05	19.50	0.50

WATER CHEMISTRY, SEPTEMBER 1996 SUMMARY

MODAY YR	STA	DEP	K	P	Mg	Ca	TP	TSP	TN	TSN	NH3	N03	SRP	SO4	TOC	DOC	TMN	DMn	TFe	DFe	TALK	TURB
9 23 96	BR	0	2.17	0.32	0.91	3.44	0.008	0.004	0.272	0.223	ND	0.003	0.003	0.985	1.14	2.03	-0.05	-0.05	-0.05	-0.05	13.00	0.45
9 23 96	BR	10	2.19	0.32	0.92	3.53	0.007	0.003	0.193	0.117	ND	0.003	0.001	1.006	1.12	1.20	-0.05	-0.05	-0.05	-0.05	13.00	0.47
9 23 96	BR	15									ND				1.09	1.00						
9 23 96	BR	20	2.01	0.28	0.89	3.91	0.006	0.004	0.216	0.193	0.010	0.017	0.002	1.130	1.02	0.93	-0.05	-0.05	-0.05	-0.05	13.50	0.50
9 23 96	BR	30	1.88	0.25	0.83	3.58	0.005	0.004	0.178	0.139	0.012	0.027	0.002	0.998	0.96	1.01	-0.05	-0.05	0.07	-0.05	11.50	1.00
9 23 96	BR	40	1.96	0.28	0.80	3.09	0.009	0.006	0.139	0.180	0.018	0.021	0.004	0.698	12.56	1.10	-0.05	-0.05	0.27	-0.05	11.50	1.40
9 23 96	BR	50	1.97	0.28	0.89	3.64	0.019	0.007	-9	0.164	0.019	0.040	0.005	0.769	9.71	1.05	-0.05	-0.05	0.53	-0.05	12.75	3.20
9 25 96	CR	0	2.57	0.74	1.45	3.83	0.008	0.005	0.128	0.202	ND	0.000	0.005	0.344	0.59	0.56	-0.05	-0.05	0.07	-0.05	16.75	0.42
9 25 96	CR	10	2.59	0.75	1.44	3.81	0.006	0.004	0.152	0.168	ND	0.001	0.002	0.235	0.56	0.52	-0.05	-0.05	0.07	-0.05	17.75	0.50
9 25 96	CR	20	2.63	0.86	1.62	4.28	0.014	0.007	0.166	0.141	ND	0.001	0.009	0.222	0.49	0.38	-0.05	-0.05	0.06	-0.05	18.00	0.56
9 25 96	CR	30	2.70	0.88	1.68	4.38	0.026	0.023	0.092	0.139	ND	0.003	0.021	0.249	0.48	0.28	-0.05	-0.05	0.07	-0.05	18.75	0.73
9 25 96	CR	40	2.02	0.53	1.26	3.41	0.020	0.017	0.180	0.256	ND	0.060	0.015	0.272	0.77	0.78	-0.05	-0.05	0.14	-0.05	13.25	2.00
9 25 96	CR	50	1.99	0.53	1.24	3.35	0.020	0.017	0.297	0.247	ND	0.046	0.015	0.292	0.81	0.74	-0.05	-0.05	0.17	-0.05	12.75	2.80
9 25 96	CR	60	1.92	0.52	1.23	3.35	0.022	0.019	0.276	0.189	ND	0.044	0.014	0.282	0.84	0.85	-0.05	-0.05	0.20	0.05	13.00	3.70
9 25 96	CR	70	2.02	0.51	1.24	3.46	0.022	0.017	0.171	0.272	ND	0.057	0.013	0.294	0.81	0.87	-0.05	-0.05	0.20	-0.05	14.00	3.90
9 25 96	CR	80	2.17	0.52	1.33	3.78	0.022	0.016	0.236	0.243	ND	0.110	0.012	0.361	0.84	0.83	-0.05	-0.05	0.30	-0.05	14.75	4.70
9 25 96	CR	90	2.94	0.55	1.80	4.99	0.041	0.017	0.752	0.333	0.038	0.176	0.006	0.353	1.05	1.04	0.44	0.32	0.66	0.14	20.50	7.60
9 25 96	CR	LO	2.47	0.51	1.21	3.66	0.020	0.018	0.213	0.157	ND	0.005	0.017	0.298	0.61	0.60	-0.05	-0.05	-0.05	-0.05	14.00	0.30
9 25 96	BR	IN	2.88	0.27	1.15	4.78	0.013	0.013	0.121	-9	ND	0.005	0.010	2.212	0.67	0.55	-0.05	-0.05	-0.05	-0.05	15.00	0.16
9 25 96	BR	OUT	1.91	0.29	0.89	3.45	0.016	0.007	0.263	0.254	ND	0.026	0.004	0.668	0.98	0.84	-0.05	-0.05	0.40	-0.05	10.00	2.80
9 25 96	SF	IN	3.10	1.13	1.99	4.88	0.039	0.038	0.189	0.196	ND	0.002	0.038	0.217	0.20	0.31	-0.05	-0.05	0.06	-0.05	21.50	0.12
9 25 96	CR	OUT	2.64	0.81	1.60	4.19	0.023	0.020	0.263	0.254	ND	0.014	0.017	0.260	3.12	0.46	-0.05	-0.05	-0.05	-0.05	16.50	0.66
9 25 96	MR	UP	4.64	1.17	2.19	4.25	0.054	0.050	0.261	0.157	ND	0.000	0.050	1.124	0.69	0.51	-0.05	-0.05	-0.05	-0.05	25.00	0.30
9 25 96	MR	FR	3.51	0.88	1.73	3.98	0.041	0.037	0.229	0.195	ND	0.007	0.028	0.764	1.09	0.61	-0.05	-0.05	0.12	-0.05	19.50	1.50
9 25 96	MR	LD	3.48	0.85	1.73	3.96	0.037	0.033	0.207	0.250	ND	0.005	0.030	0.809	0.61	0.90	-0.05	-0.05	0.07	-0.05	20.50	0.81
9 25 96	KR	GS	3.58	0.86	1.76	4.03	0.032	0.029	0.247	0.238	ND	0.006	0.027	0.763	0.44	0.51	-0.05	-0.05	0.09	-0.05	21.25	0.73
9 25 96	MR	HB	3.49	0.86	1.80	4.15	0.031	0.027	0.218	0.175	ND	0.006	0.022	0.826	0.60	0.51	-0.05	-0.05	0.11	-0.05	21.75	0.85

APPENDIX C

HYDROLOGY DATA FOR BLUE RIVER AND COUGAR PROJECTS

Note: Data are from the log sheets produced by the project. Cougar had a daily value with one datasheet per month. Blue River had a daily sheet with hourly values. Cougar listed meteorological data as well and these were included in that dataset. Metric values were calculated from the project data based on the conversions listed in the table of conversions at the beginning of this report.

Blue River Hydrology

RES	MO	DAY	YR	TIME	STAGE	BR-IN	LC	BR OUT	Elevation (m)	Inflow (cfs)	Inflow (cms)	BR IN (cms)	Outflow (cms)
BR	1	1	96	0700	1246.39	956	469	1608	379.899672	1425	40.3515064	27.07090534	45.53348932
BR	1	2	96	0700	1251.04	579	316	1599	381.316992	895	25.3435777	16.39545418	45.2786377
BR	1	2	96	1030				2010	0	0	0	0	0
BR	1	2	96	1100				2514	0	0	0	0	0
BR	1	2	96	1130				2936	0	0	0	0	0
BR	1	3	96	0700	1240.74	467	269	2830	378.177552	736	20.8411991	13.22396736	80.13667586
BR	1	4	96	0700	1228.48	583	296	2676	374.440704	879	24.8905082	16.50872156	75.77588148
BR	1	4	96	0730				2381	0	0	0	0	0
BR	1	5	96	0700	1216.30	450	243	2228	370.72824	693	19.6235747	12.74258097	63.08993421
BR	1	6	96	0700	1201.70	558	256	2010	366.27816	814	23.0499131	15.8008004	56.91686165
BR	1	6	96	1330				1357	0	0	0	0	0
BR	1	6	96	1400				1013	0	0	0	0	0
BR	1	7	96	0700	1197.52	471	234	1007	365.004096	705	19.9633768	13.33723474	28.51506452
BR	1	8	96	0700	1206.00	1143	447	1081	367.5888	1590	45.0237861	32.36615565	30.61051117
BR	1	8	96	1200				1462	0	0	0	0	0
BR	1	8	96	1300				1846	0	0	0	0	0
BR	1	8	96	1400				2099	0	0	0	0	0
BR	1	9	96	0700	1202.98	775	369	2126	366.668304	1144	32.3944725	21.94555611	60.20161585
BR	1	10	96	0700	1197.79	908	381	2054	365.086392	1289	36.5004153	25.71169671	58.1628029
BR	1	11	96	0700	1188.11	591	302	1874	362.135928	893	25.286944	16.73525634	53.06577051
BR	1	11	96	0110				1251	0	0	0	0	0
BR	1	11	96	1130				887	0	0	0	0	0
BR	1	11	96	1200				634	0	0	0	0	0
BR	1	12	96	0700	1189.98	414	234	654	362.705904	648	18.3493166	11.72317449	18.51921767
BR	1	12	96	0730				949	0	0	0	0	0
BR	1	13	96	0700	1186.33	324	192	920	361.593384	516	14.6114928	9.174658296	26.05149886
BR	1	13	96	0800				634	0	0	0	0	0
BR	1	14	96	0700	1185.39	266	156	630	361.306872	422	11.9497093	7.532281193	17.83961335
BR	1	14	96	0800				446	0	0	0	0	0
BR	1	15	96	0700	1190.53	611	234	471	362.873544	845	23.9277354	17.30159327	13.33723474
BR	1	15	96	0730				597	0	0	0	0	0
BR	1	15	96	0800				798	0	0	0	0	0
BR	1	15	96	0830				990	0	0	0	0	0
BR	1	16	96	0700	1204.37	1337	419	1094	367.091976	1756	49.7243826	37.85962389	30.97863017
BR	1	16	96	1200				1659	0	0	0	0	0
BR	1	16	96	1230				2072	0	0	0	0	0
BR	1	16	96	1400				2540	0	0	0	0	0
BR	1	17	96	0700	1202.35	892	353	2452	366.47628	1245	35.254474	25.25862716	69.43290784
BR	1	17	96	0800				1659	0	0	0	0	0
BR	1	17	96	0830				1151	0	0	0	0	0
BR	1	18	96	0700	1203.15	563	269	1157	366.72012	832	23.5596164	15.94238463	32.76259151
BR	1	19	96	0700	1204.19	945	408	1177	367.037112	1353	38.3126934	26.75942003	33.32892844
BR	1	19	96	1200				1516	0	0	0	0	0
BR	1	19	96	1500				1007	0	0	0	0	0
BR	1	19	96	1530				522	0	0	0	0	0
BR	1	20	96	0700	1216.41	733	362	543	370.761768	1095	31.006947	20.75624855	15.3760477
BR	1	20	96	1400				1100	0	0	0	0	0
BR	1	20	96	1430				1477	0	0	0	0	0
BR	1	21	96	0700	1221.78	632	391	1500	372.398544	1023	28.9681341	17.89624705	42.47526989
BR	1	22	96	0700	1219.22	407	267	1462	371.618256	674	19.0855546	11.52495656	41.39922972
BR	1	23	96	0700	1212.50	324	208	1402	369.57	532	15.0645624	9.174658296	39.70021892
BR	1	23	96	1200				1007	0	0	0	0	0
BR	1	24	96	0700	1208.08	280	179	995	368.222784	459	12.9974326	7.928717046	28.17526236
BR	1	25	96	0700	1203.35	241	148	960	366.78108	389	11.0152533	6.824360029	27.18417273
BR	1	25	96	0730				995	0	0	0	0	0
BR	1	26	96	0700	1196.44	212	123	949	364.674912	335	9.48614361	6.003171478	26.87268742
BR	1	26	96	0800				1001	0	0	0	0	0
BR	1	27	96	0700	1187.68	206	117	935	362.004864	323	9.14634145	5.833270398	26.47625156
BR	1	27	96	1000				654	0	0	0	0	0
BR	1	27	96	1030				404	0	0	0	0	0
BR	1	28	96	0700	1189.38	218	123	416	362.523024	341	9.65604469	6.173072557	11.77980818
BR	1	29	96	0700	1191.35	194	113	424	363.12348	307	8.6932719	5.493468239	12.00634296
BR	1	30	96	0700	1191.63	175	98	420	363.208824	273	7.73049912	4.955448154	11.89307557
BR	1	30	96	0900				301	0	0	0	0	0
BR	1	31	96	0700	1192.64	161	89	292	363.516672	250	7.07921165	4.559012301	8.268519205
BR	1	31	96	1330				208	0	0	0	0	0
BR	1	31	96	1400				135	0	0	0	0	0
BR	1	31	96	1430				90	0	0	0	0	0
BR	1	31	96	1500				46	0	0	0	0	0

Blue River Hydrology

BR	2	1	96	0700	1196.01	60	82	45	364.543848	142	4.02099222	1.699010796	1.274258097
BR	2	2	96	0700	1199.80	139	74	47	365.69904	213	6.03148832	3.936041676	1.33089179
BR	2	3	96	0700	1203.02	131	71	47	366.680496	202	5.72000301	3.709506904	1.33089179
BR	2	4	96	0700	1206.16	161	86	49	367.637568	247	6.99426111	4.559012301	1.387525483
BR	2	5	96	0700	1211.12	287	140	52	369.149376	427	12.0912935	8.126934972	1.472476023
BR	2	6	96	0700	1229.48	3365	981	78	374.745504	4346	123.065015	95.28618878	2.208714034
BR	2	7	96	0700	1286.64	7213		127	392.167872	7213	204.249414	204.2494145	3.596239517
BR	2	7	96	0730				90	0	0	0	0	0
BR	2	8	96	0700	1324.93	2942		55	403.838664	2942	83.3081627	83.30816267	1.557426563
BR	2	9	96	0230				135	0	0	0	0	0
BR	2	9	96	0300	1338.90			301	0	0	0	0	0
BR	2	9	96	0400				392	0	0	0	0	0
BR	2	9	96	0500				497	0	0	0	0	0
BR	2	9	96	0600				592	0	0	0	0	0
BR	2	9	96	0700	1342.12	3708		766	409.078176	3708	104.998867	104.9988672	21.69070449
BR	2	9	96	0800				1007	0	0	0	0	0
BR	2	9	96	1600				1203	0	0	0	0	0
BR	2	9	96	1700				1402	0	0	0	0	0
BR	2	9	96	1800				1608	0	0	0	0	0
BR	2	9	96	1900				1791	0	0	0	0	0
BR	2	9	96	2000				1992	0	0	0	0	0
BR	2	10	96	0100				2523	0	0	0	0	0
BR	2	10	96	0200				3007	0	0	0	0	0
BR	2	10	96	0300				3525	0	0	0	0	0
BR	2	10	96	0400				3714	0	0	0	0	0
BR	2	10	96	0700	1348.73	1484	####	3714	411.092904	2500	70.7921165	42.02220034	105.1687682
BR	2	11	96	0700	1344.71	806	630	3689	409.867608	1436	40.6629917	22.82337835	104.4608471
BR	2	11	96	0730				3714	0	0	0	0	0
BR	2	12	96	0700	1338.97	670	503	3689	408.118056	1173	33.2156611	18.97228722	104.4608471
BR	2	12	96	0800				3714	0	0	0	0	0
BR	2	13	96	0700	1332.84	706	476	3650	406.249632	1182	33.4705127	19.99169369	103.3564901
BR	2	13	96	0730				3701	0	0	0	0	0
BR	2	14	96	0700	1326.43	679	469	3638	404.295864	1148	32.5077399	19.22713884	103.0166879
BR	2	15	96	0700	1319.69	648	447	3650	402.241512	1095	31.006947	18.34931659	103.3564901
BR	2	16	96	0700	1312.21	624	436	3752	399.961608	1060	30.0158574	17.66971227	106.2448084
BR	2	17	96	0700	1304.46	684	473	3663	397.599408	1157	32.7625915	19.36872307	103.7246091
BR	2	17	96	1300				3739	0	0	0	0	0
BR	2	18	96	0700	1297.81	1778	702	3701	395.572488	2480	70.2257795	50.34735324	104.8006492
BR	2	18	96	0800				2957	0	0	0	0	0
BR	2	18	96	1100				1992	0	0	0	0	0
BR	2	19	96	0700	1294.95	1357	740	2001	394.70076	2097	59.3804273	38.42596083	56.66201003
BR	2	20	96	0700	1300.06	897	829	2001	396.258288	1726	48.8748772	25.40021139	56.66201003
BR	2	20	96	1200				2505	0	0	0	0	0
BR	2	20	96	1430				2876	0	0	0	0	0
BR	2	20	96	1500				2995	0	0	0	0	0
BR	2	21	96	0700	1295.68	620	469	2947	394.923264	1089	30.8370459	17.55644489	83.44974691
BR	2	22	96	0700	1288.97	457	388	2853	392.878056	845	23.9277354	12.94079889	80.78796333
BR	2	22	96	0900				3007	0	0	0	0	0
BR	2	22	96	1200				2505	0	0	0	0	0
BR	2	22	96	1300				2001	0	0	0	0	0
BR	2	23	96	0700	1283.73	394	353	1992	391.280904	747	21.1526844	11.15683756	56.40715841
BR	2	23	96	0800				1591	0	0	0	0	0
BR	2	23	96	0830				1184	0	0	0	0	0
BR	2	23	96	0900				809	0	0	0	0	0
BR	2	23	96	0930				620	0	0	0	0	0
BR	2	23	96	1000				518	0	0	0	0	0
BR	2	24	96	0700	1284.32	311	304	522	391.460736	615	17.4148607	8.80653929	14.78139392
BR	2	25	96	0700	1284.74	208	272	522	391.588752	480	13.5920864	5.889904091	14.78139392
BR	2	26	96	0700	1284.80	231	251	522	391.60704	482	13.6487201	6.541191563	14.78139392
BR	2	26	96	1000				392	0	0	0	0	0
BR	2	26	96	1030				301	0	0	0	0	0
BR	2	26	96	1100				208	0	0	0	0	0
BR	2	26	96	1130				124	0	0	0	0	0
BR	2	26	96	1200				49	0	0	0	0	0
BR	2	27	96	0700	1286.08	208	231	48	391.997184	439	12.4310957	5.889904091	1.359208636
BR	2	28	96	0700	1287.44	188	217	47	392.411712	405	11.4683229	5.323567159	1.33089179
BR	2	29	96	0700	1288.64	122	204	47	392.777472	326	9.23129199	3.454655284	1.33089179
BR	3	1	96	0700	1289.66	166	195	57	393.088368	361	10.2223816	4.700596534	1.614060256
BR	3	2	96	0700	1290.68	172	190	57	393.399264	362	10.2506985	4.870497614	1.614060256
BR	3	3	96	0700	1291.80	210	201	58	393.74064	411	11.6382239	5.946537784	1.642377102

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BR	3	4	96	0700	1293.49	332	243	58	394.255752	575	16.2821868	9.401193069	1.642377102
BR	3	5	96	0700	1296.09	460	302	60	395.048232	762	21.5774371	13.02574943	1.699010796
BR	3	6	96	0700	1298.69	358	285	61	395.840712	643	18.2077324	10.13743108	1.727327642
BR	3	7	96	0700	1300.71	319	264	61	396.456408	583	16.5087216	9.033074063	1.727327642
BR	3	8	96	0700	1302.55	345	264	60	397.01724	609	17.2449596	9.769312074	1.699010796
BR	3	8	96	1100				112	0	0	0	0	0
BR	3	8	96	1130				203	0	0	0	0	0
BR	3	9	96	0700	1304.30	446	302	203	397.55064	748	21.1810013	12.62931358	5.748319858
BR	3	10	96	0700	1306.33	464	325	206	398.169384	789	22.341992	13.13901682	5.833270398
BR	3	11	96	0700	1308.33	481	353	206	398.778984	834	23.6162501	13.62040321	5.833270398
BR	3	11	96	0830				392	0	0	0	0	0
BR	3	11	96	0900				583	0	0	0	0	0
BR	3	11	96	0930				814	0	0	0	0	0
BR	3	11	96	1000				995	0	0	0	0	0
BR	3	12	96	0700	1308.41	510	356	984	398.803368	866	24.5223891	14.44159176	27.86377705
BR	3	13	96	0700	1308.00	404	319	984	398.6784	723	20.4730801	11.44000602	27.86377705
BR	3	13	96	0930				803	0	0	0	0	0
BR	3	14	96	0700	1307.62	326	285	809	398.562576	611	17.3015933	9.231291989	22.90832889
BR	3	14	96	1330				606	0	0	0	0	0
BR	3	14	96	1400				408	0	0	0	0	0
BR	3	14	96	1430				298	0	0	0	0	0
BR	3	15	96	0700	1308.03	289	264	295	398.687544	553	15.6592162	8.183568665	8.353469745
BR	3	15	96	1000				208	0	0	0	0	0
BR	3	16	96	0700	1308.94	255	243	206	398.964912	498	14.1017896	7.220795881	5.833270398
BR	3	17	96	0700	1309.70	227	229	206	399.19656	456	12.912482	6.427924176	5.833270398
BR	3	18	96	0700	1310.33	214	217	208	399.388584	431	12.2045609	6.059805171	5.889904091
BR	3	18	96	1000				155	0	0	0	0	0
BR	3	18	96	1130				101	0	0	0	0	0
BR	3	18	96	1200				49	0	0	0	0	0
BR	3	19	96	0700	1311.26	212	217	49	399.672048	429	12.1479272	6.003171478	1.387525483
BR	3	20	96	0700	1312.29	206	211	49	399.985992	417	11.808125	5.833270398	1.387525483
BR	3	21	96	0700	1313.19	190	204	49	400.260312	394	11.1568376	5.380200852	1.387525483
BR	3	22	96	0700	1314.08	192	211	49	400.531584	403	11.4116892	5.436834546	1.387525483
BR	3	23	96	0700	1314.95	177	199	49	400.79676	376	10.6471343	5.012081847	1.387525483
BR	3	24	96	0700	1315.72	164	188	49	401.031456	352	9.96753	4.643962841	1.387525483
BR	3	25	96	0700	1316.40	150	176	49	401.23872	326	9.23129199	4.247526989	1.387525483
BR	3	26	96	0700	1317.00	139	170	49	401.4216	309	8.7499056	3.936041676	1.387525483
BR	3	27	96	0700	1317.55	130	166	50	401.58924	296	8.38178659	3.681190057	1.41584233
BR	3	28	96	0700	1318.10	128	164	50	401.75688	292	8.2685192	3.624556364	1.41584233
BR	3	29	96	0700	1318.59	121	158	50	401.906232	279	7.9004002	3.426338438	1.41584233
BR	3	30	96	0700	1319.06	115	152	50	402.049488	267	7.56059804	3.256437358	1.41584233
BR	3	31	96	0700	1319.51	119	156	50	402.186648	275	7.78713281	3.369704744	1.41584233
BR	4	1	96	0700	1321.12	563	313	55	402.677376	876	24.8055576	15.94238463	1.557426563
BR	4	2	96	0700	1323.75	464	334	55	403.479	798	22.5968436	13.13901682	1.557426563
BR	4	3	96	0700	1325.97	385	313	54	404.155656	698	19.7651589	10.90198594	1.529109716
BR	4	3	96	1030				108	0	0	0	0	0
BR	4	3	96	1100				187	0	0	0	0	0
BR	4	3	96	1130				283	0	0	0	0	0
BR	4	3	96	1200				404	0	0	0	0	0
BR	4	3	96	1230				497	0	0	0	0	0
BR	4	4	96	0700	1326.74	301	272	497	404.390352	573	16.2255531	8.523370824	14.07347276
BR	4	5	96	0700	1326.91	257	251	497	404.442168	508	14.3849581	7.277429574	14.07347276
BR	4	5	96	0900				349	0	0	0	0	0
BR	4	5	96	1000				255	0	0	0	0	0
BR	4	5	96	1030				185	0	0	0	0	0
BR	4	5	96	1100				96	0	0	0	0	0
BR	4	5	96	1130				50	0	0	0	0	0
BR	4	6	96	0700	1327.91	241	243	49	404.746968	484	13.7053538	6.824360029	1.387525483
BR	4	7	96	0700	1328.93	233	243	49	405.057864	476	13.478819	6.597825256	1.387525483
BR	4	8	96	0700	1330.00	231	251	49	405.384	482	13.6487201	6.541191563	1.387525483
BR	4	8	96	1100				117	0	0	0	0	0
BR	4	9	96	0700	1330.90			117	405.65832	0	0	0	3.313071051
BR	4	10	96	0700	1331.68	200	236	131	405.896064	436	12.3461451	5.663369318	3.709506904
BR	4	11	96	0700	1332.43	198	229	117	406.124664	427	12.0912935	5.606735625	3.313071051
BR	4	11	96	1100				147	0	0	0	0	0
BR	4	12	96	0700	1333.55	259	238	148	406.46604	497	14.0734728	7.334063267	4.190893296
BR	4	12	96	1100				206	0	0	0	0	0
BR	4	12	96	1130				300	0	0	0	0	0
BR	4	13	96	0700				286	0.3048	0	0	0	8.098618125
BR	4	14	96	0700	1335.30	332	261	303	406.99944	593	16.79189	9.401193069	8.580004517

Blue River Hydrology

BR	4	15	96	0700	1336.19	342	267	303	407.270712	609	17.2449596	9.684361534	8.580004517
BR	4	16	96	0700	1337.12	329	288	306	407.554176	617	17.4714943	9.316242529	8.664955057
BR	4	16	96	1000				390	0	0	0	0	0
BR	4	16	96	1030				513	0	0	0	0	0
BR	4	17	96	0700	1337.71	458	291	505	407.734008	749	21.2093181	12.96911574	14.30000753
BR	4	17	96	1030				704	0	0	0	0	0
BR	4	18	96	0700	1337.67	321	272	699	407.721816	593	16.79189	9.089707756	19.79347577
BR	4	19	96	0700	1337.62	364	283	704	407.706576	647	18.3209997	10.30733216	19.93506
BR	4	20	96	0700	1337.63		283	694	407.709624	283	8.01366759	0	19.65189153
BR	4	21	96	0700	1337.65		280	694	407.71572	280	7.92871705	0	19.65189153
BR	4	22	96	0700	1337.69		310	699	407.727912	310	8.77822244	0	19.79347577
BR	4	22	96	1500				892	0	0	0	0	0
BR	4	23	96	0700	1340.51		648	898	408.587448	648	18.3493166	0	25.42852824
BR	4	23	96	0830				1107	0	0	0	0	0
BR	4	23	96	0900				1286	0	0	0	0	0
BR	4	23	96	0930				1516	0	0	0	0	0
BR	4	24	96	0700	1346.25	####		1541	410.337	1176	33.3006116	0	43.6362606
BR	4	24	96	0730				1031	0	0	0	0	0
BR	4	24	96	1200				1492	0	0	0	0	0
BR	4	24	96	1230				1865	0	0	0	0	0
BR	4	24	96	1300				2191	0	0	0	0	0
BR	4	24	96	1330				2487	0	0	0	0	0
BR	4	25	96	0700	1348.77		716	2461	411.105096	716	20.2748622	0	69.68775946
BR	4	26	96	0700	1346.84		529	2461	410.516832	529	14.9796118	0	69.68775946
BR	4	26	96	1000				2117	0	0	0	0	0
BR	4	26	96	1030				1819	0	0	0	0	0
BR	4	26	96	1100				1533	0	0	0	0	0
BR	4	26	96	1500				1031	0	0	0	0	0
BR	4	27	96	0700	1346.32		419	1031	410.358336	419	11.8647587	0	29.19466884
BR	4	28	96	0700	1345.84		346	1031	410.212032	346	9.79762892	0	29.19466884
BR	4	28	96	1100				806	0	0	0	0	0
BR	4	29	96	0700	1345.38		299	806	410.071824	299	8.46673713	0	22.82337835
BR	4	29	96	0930				611	0	0	0	0	0
BR	4	30	96	0700	1345.14		255	611	409.998672	524	14.8380276	7.220795881	17.30159327
BR	4	30	96	0730				509	0	0	0	0	0
BR	5	1	96	0700	1345.12		229	509	409.992576	483	13.6770369	6.48455787	14.41327492
BR	5	1	96	1000				400	0	0	0	0	0
BR	5	2	96	0700	1345.16		202	400	410.004768	436	12.3461451	5.720003012	11.32673864
BR	5	3	96	0700	1345.14		185	396	409.998672	400	11.3267386	5.23861662	11.21347125
BR	5	3	96	1100				309	0	0	0	0	0
BR	5	4	96	0700	1345.21		166	309	410.020008	372	10.5338669	4.700596534	8.749905597
BR	5	5	96	0700	1345.22		153	309	410.023056	345	9.76931207	4.332477529	8.749905597
BR	5	5	96	0730				215	0	0	0	0	0
BR	5	5	96	0800				114	0	0	0	0	0
BR	5	5	96	0900				54	0	0	0	0	0
BR	5	6	96	0700	1345.73		139	54	410.178504	322	9.1180246	3.936041676	1.529109716
BR	5	7	96	0700	1346.21		130	54	410.324808	306	8.66495506	3.681190057	1.529109716
BR	5	8	96	0700	1346.64		122	54	410.455872	290	8.21188551	3.454655284	1.529109716
BR	5	9	96	0700	1347.03		115	54	410.574744	277	7.84376651	3.256437358	1.529109716
BR	5	10	96	0700	1347.39		110	54	410.684472	268	7.58891489	3.114853125	1.529109716
BR	5	11	96	0700	1347.74		104	54	410.791152	258	7.30574642	2.944952046	1.529109716
BR	5	12	96	0700	1348.00		102	54	410.8704	256	7.24911273	2.888318352	1.529109716
BR	5	13	96	0700	1348.40		107	54	410.99232	267	7.56059804	3.029902585	1.529109716
BR	5	14	96	0700	1348.98		194	54	411.169104	420	11.8930756	5.493468239	1.529109716
BR	5	14	96	1000				114	0	0	0	0	0
BR	5	14	96	1030				199	0	0	0	0	0
BR	5	14	96	1200				300	0	0	0	0	0
BR	5	14	96	1230				380	0	0	0	0	0
BR	5	14	96	1300				444	0	0	0	0	0
BR	5	15	96	0700	1349.50		467	453	411.3276	766	21.6907045	13.22396736	12.82753151
BR	5	15	96	0715				550	0	0	0	0	0
BR	5	15	96	0745				723	0	0	0	0	0
BR	5	15	96	0800				990	0	0	0	0	0
BR	5	15	96	0830				1197	0	0	0	0	0
BR	5	15	96	1200				1541	0	0	0	0	0
BR	5	16	96	0700	1349.11		563	1533	411.208728	900	25.4851619	15.94238463	43.40972583
BR	5	16	96	0730				1197	0	0	0	0	0
BR	5	16	96	1100				909	0	0	0	0	0
BR	5	17	96	0700	1349.00		433	903	411.1752	752	21.2942686	12.26119457	25.57011247
BR	5	17	96	0730				714	0	0	0	0	0

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BR	5	18	96	0700	1350.38	747	454	719	411.595824	1201	34.0085328	21.1526844	20.3598127
BR	5	18	96	0830				909	0	0	0	0	0
BR	5	18	96	0900				1197	0	0	0	0	0
BR	5	18	96	0930				1541	0	0	0	0	0
BR	5	19	96	0700	1350.49	835	476	1516	411.629352	1311	37.1233859	23.6445669	42.92833943
BR	5	20	96	0700	1350.13	637	415	1541	411.519624	1052	29.7893226	18.03783128	43.6362606
BR	5	20	96	0930				1197	0	0	0	0	0
BR	5	21	96	0700	1349.48	453	343	1190	411.321504	796	22.5402099	12.82753151	33.69704744
BR	5	21	96	0730				909	0	0	0	0	0
BR	5	21	96	1100				714	0	0	0	0	0
BR	5	22	96	0700	1349.79	595	365	714	411.415992	960	27.1841727	16.84852372	20.21822847
BR	5	22	96	0800				887	0	0	0	0	0
BR	5	22	96	1530				1087	0	0	0	0	0
BR	5	23	96	0700	1350.42	675	401	1094	411.608016	1076	30.4689269	19.11387145	30.97863017
BR	5	23	96	0730				1365	0	0	0	0	0
BR	5	24	96	0700	1350.01	563	369	1357	411.483048	932	26.391301	15.94238463	38.42596083
BR	5	24	96	0800				1007	0	0	0	0	0
BR	5	24	96	1500				914	0	0	0	0	0
BR	5	25	96	0700	1349.86	401	328	909	411.437328	729	20.6429812	11.35505548	25.74001355
BR	5	25	96	1800				704	0	0	0	0	0
BR	5	25	96	0900				513	0	0	0	0	0
BR	5	26	96	0700	1350.14	319	288	517	411.522672	607	17.1883259	9.033074063	14.63980969
BR	5	26	96	1100				611	0	0	0	0	0
BR	5	27	96	0700	1350.08	264	259	611	411.504384	523	14.8097108	7.4756475	17.30159327
BR	5	27	96	0730				517	0	0	0	0	0
BR	5	28	96	0700	1349.98	227	236	513	411.473904	463	13.1107	6.427924176	14.5265423
BR	5	28	96	0830				404	0	0	0	0	0
BR	5	28	96	0900				312	0	0	0	0	0
BR	5	29	96	0700	1350.20	200	220	309	411.54096	420	11.8930756	5.663369318	8.749905597
BR	5	30	96	0700	1350.31	179	206	309	411.574488	385	10.9019859	5.06871554	8.749905597
BR	5	30	96	0800				215	0	0	0	0	0
BR	5	30	96	0900				108	0	0	0	0	0
BR	5	31	96	0700	1350.79	161	192	108	411.720792	353	9.99584685	4.559012301	3.058219432
BR	6	1	96	0700	1351.23	144	181	108	411.854904	325	9.20297514	4.077625909	3.058219432
BR	6	1	96	0730				202	0	0	0	0	0
BR	6	1	96	0800				243	0	0	0	0	0
BR	6	2	96	0700	1351.32	135	174	243	411.882336	309	8.7499056	3.82277429	6.880993722
BR	6	3	96	0700	1351.33	125	164	243	411.885384	289	8.18356867	3.539605824	6.880993722
BR	6	3	96	1500				202	0	0	0	0	0
BR	6	4	96	0700	1351.36	116	158	202	411.894528	274	7.75881597	3.284754205	5.720003012
BR	6	5	96	0700	1351.40	112	154	202	411.90672	266	7.53228119	3.171486818	5.720003012
BR	6	6	96	0700	1351.41	102	146	202	411.909768	248	7.02257795	2.888318352	5.720003012
BR	6	6	96	0830				19	0	0	0	0	0
BR	6	6	96	1200				209	0	0	0	0	0
BR	6	7	96	0700	1351.44	97	65	209	411.918912	162	4.58732915	2.746734119	5.918220938
BR	6	8	96	0700	1351.37	92	137	206	411.897576	229	6.48455787	2.605149886	5.833270398
BR	6	8	96	0730				167	0	0	0	0	0
BR	6	9	96	0700	1351.38	88	133	167	411.900624	221	6.2580231	2.4918825	4.728913381
BR	6	10	96	0700	1351.37	83	131	167	411.897576	214	6.05980517	2.350298267	4.728913381
BR	6	11	96	0700	1351.34	77	120	171	411.888432	197	5.57841878	2.180397188	4.842180767
BR	6	12	96	0700	1351.29	77	120	171	411.873192	197	5.57841878	2.180397188	4.842180767
BR	6	13	96	0700	1351.27	75	116	154	411.867096	191	5.4085177	2.123763494	4.360794375
BR	6	13	96	1000				111	0	0	0	0	0
BR	6	13	96	1030				50	0	0	0	0	0
BR	6	14	96	0700	1351.41	72	117	54	411.909768	189	5.35188401	2.038812955	1.529109716
BR	6	15	96	0700	1351.57	72	116	54	411.958536	188	5.32356716	2.038812955	1.529109716
BR	6	16	96	0700	1351.71	67	114	54	412.001208	181	5.12534923	1.897228722	1.529109716
BR	6	17	96	0700	1351.85	66	113	54	412.04388	179	5.06871554	1.868911875	1.529109716
BR	6	18	96	0700	1352.03	70	116	54	412.098744	186	5.26693347	1.982179261	1.529109716
BR	6	18	96	0900				76	0	0	0	0	0
BR	6	18	96	1100				77	0	0	0	0	0
BR	6	19	96	0700	1352.10	66	111	77	412.12008	177	5.01208185	1.868911875	2.180397188
BR	6	20	96	0700	1352.15	61	108	77	412.13532	169	4.78554707	1.727327642	2.180397188
BR	6	21	96	0700	1352.18	59	106	77	412.144464	165	4.67227969	1.670693949	2.180397188
BR	6	22	96	0700	1352.20	57	105	77	412.15056	162	4.58732915	1.614060256	2.180397188
BR	6	23	96	0700	1352.25	61	108	78	412.1658	169	4.78554707	1.727327642	2.208714034
BR	6	24	96	0700	1352.52	109	126	78	412.248096	235	6.65445895	3.086536279	2.208714034
BR	6	24	96	0900				134	0	0	0	0	0
BR	6	24	96	0930				198	0	0	0	0	0
BR	6	25	96	0700	1352.56	92	122	189	412.260288	214	6.05980517	2.605149886	5.351884006

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BR	6	26	96	0700	1352.48	86	120	189	412.235904	206	5.8332704	2.435248807	5.351884006
BR	6	27	96	0700	1352.36	75	142	189	412.199328	217	6.14475571	2.123763494	5.351884006
BR	6	28	96	0700	1352.22	72	131	189	412.156656	203	5.74831986	2.038812955	5.351884006
BR	6	28	96	1100				156	0	0	0	0	0
BR	6	29	96	0700	1352.12	66	122	154	412.126176	188	5.32356716	1.868911875	4.360794375
BR	6	30	96	0700	1352.00	0.61	1.2	154	412.0896	1.8	0.05097032	0.017273276	4.360794375
BR	7	1	96	0700	1351.86	58	116	154	412.046928	174	4.92713131	1.642377102	4.360794375
BR	7	1	96	0800				97	0	0	0	0	0
BR	7	1	96	0830				54	0	0	0	0	0
BR	7	2	96	0700	1351.94	56	114	53	412.071312	170	4.81386392	1.585743409	1.500792869
BR	7	3	96	0700	1352.00	53	113	53	412.0896	166	4.70059653	1.500792869	1.500792869
BR	7	4	96	0700	1352.06	51	111	53	412.107888	162	4.58732915	1.444159176	1.500792869
BR	7	5	96	0700	1352.12	49	108	53	412.126176	157	4.44574491	1.387525483	1.500792869
BR	7	6	96	0700	1352.15	48	106	53	412.15332	154	4.36079438	1.359208636	1.500792869
BR	7	7	96	0700	1352.18	46	103	53	412.144464	149	4.21921014	1.302574943	1.500792869
BR	7	8	96	0700	1352.21	46	103	53	412.153608	149	4.21921014	1.302574943	1.500792869
BR	7	9	96	0700	1352.23	45	102	53	412.159704	147	4.16257645	1.274258097	1.500792869
BR	7	10	96	0700	1352.26	43	101	53	412.168848	144	4.07762591	1.217624403	1.500792869
BR	7	11	96	0700	1352.27	40	99	54	412.171896	139	3.93604168	1.132673864	1.529109716
BR	7	12	96	0700	1352.28	39	99	56	412.174944	138	3.90772483	1.104357017	1.585743409
BR	7	13	96	0700	1352.29	39	99	54	412.177992	138	3.90772483	1.104357017	1.529109716
BR	7	14	96	0700	1352.29	38	96	54	412.177992	134	3.79445744	1.07604017	1.529109716
BR	7	15	96	0700	1352.30	39	96	54	412.18104	135	3.82277429	1.104357017	1.529109716
BR	7	16	96	0700	1352.29	35	95	54	412.177992	130	3.68119006	0.991089631	1.529109716
BR	7	17	96	0700	1352.26	35	93	54	412.168848	128	3.62455636	0.991089631	1.529109716
BR	7	18	96	0700	1352.32	47	102	54	412.187136	149	4.21921014	1.33089179	1.529109716
BR	7	19	96	0700	1352.33	47	98	54	412.190184	145	4.10594276	1.33089179	1.529109716
BR	7	20	96	0700	1352.33	38	95	54	412.190184	133	3.7661406	1.07604017	1.529109716
BR	7	21	96	0700	1352.31	36	93	54	412.184088	129	3.65287321	1.019406477	1.529109716
BR	7	22	96	0700	1352.30	35	92	54	412.18104	127	3.59623952	0.991089631	1.529109716
BR	7	23	96	0700	1352.28	35	90	54	412.174944	125	3.53960582	0.991089631	1.529109716
BR	7	24	96	0700	1352.26	32	89	54	412.168848	121	3.42633844	0.906139091	1.529109716
BR	7	25	96	0700	1352.23	31	89	53	412.159704	120	3.39802159	0.877822244	1.500792869
BR	7	26	96	0700	1352.20	30	89	53	412.15056	119	3.36970474	0.849505398	1.500792869
BR	7	27	96	0700	1352.16	29	88	53	412.138368	117	3.31307105	0.821188551	1.500792869
BR	7	28	96	0700	1352.13	28	87	53	412.129224	115	3.25643736	0.792871705	1.500792869
BR	7	29	96	0700	1352.11	30	88	53	412.123128	118	3.3413879	0.849505398	1.500792869
BR	7	30	96	0700	1352.06	29	87	54	412.107888	116	3.2847542	0.821188551	1.529109716
BR	7	31	96	0700	1352.02	27	86	54	412.095696	113	3.19980366	0.764554858	1.529109716
BR	8	1	96	0700	1351.97	27	86	54	412.080456	113	3.19980366	0.764554858	1.529109716
BR	8	2	96	0700	1351.92	27	86	54	412.065216	113	3.19980366	0.764554858	1.529109716
BR	8	2	96	1200				116	0	0	0	0	0
BR	8	2	96	1230				187	0	0	0	0	0
BR	8	2	96	1300				318	0	0	0	0	0
BR	8	2	96	1330				398	0	0	0	0	0
BR	8	2	96	1400				518	0	0	0	0	0
BR	8	2	96	1430				589	0	0	0	0	0
BR	8	2	96	1500				701	0	0	0	0	0
BR	8	2	96	1530				898	0	0	0	0	0
BR	8	3	96	0700	1350.51	30	87	898	411.635448	117	3.31307105	0.849505398	25.42852824
BR	8	3	96	1200				721	0	0	0	0	0
BR	8	3	96	1230				631	0	0	0	0	0
BR	8	3	96	1300				574	0	0	0	0	0
BR	8	3	96	1330				410	0	0	0	0	0
BR	8	3	96	1400				318	0	0	0	0	0
BR	8	3	96	1430				208	0	0	0	0	0
BR	8	3	96	1500				118	0	0	0	0	0
BR	8	3	96	1530				54	0	0	0	0	0
BR	8	4	96	0700	1349.91	29	86	50	411.452568	115	3.25643736	0.821188551	1.41584233
BR	8	5	96	0700	1349.87	28	84	50	411.440376	112	3.17148682	0.792871705	1.41584233
BR	8	6	96	0700	1349.82	27	84	50	411.425136	111	3.14316997	0.764554858	1.41584233
BR	8	7	96	0700	1349.77	26	83	50	411.409896	109	3.08653628	0.736238011	1.41584233
BR	8	8	96	0700	1349.71	24	83	50	411.391608	107	3.02990259	0.679604318	1.41584233
BR	8	9	96	0700	1349.66	24	82	49	411.376368	106	3.00158574	0.679604318	1.387525483
BR	8	10	96	0700	1349.61	23	82	49	411.361128	105	2.97326889	0.651287472	1.387525483
BR	8	11	96	0700	1349.55	22	80	49	411.34284	102	2.88831835	0.622970625	1.387525483
BR	8	12	96	0700	1349.49	22	79	50	411.324552	101	2.86000151	0.622970625	1.41584233
BR	8	13	96	0700	1349.44	23	80	50	411.309312	103	2.9166352	0.651287472	1.41584233
BR	8	14	96	0700	1349.37	22	79	50	411.287976	101	2.86000151	0.622970625	1.41584233
BR	8	15	96	0700	1349.31	21	79	50	411.269688	100	2.83168466	0.594653778	1.41584233

Blue River Hydrology

BR	8	16	96	0700	1349.24	21	79	50	411.248352	100	2.83168466	0.594653778	1.41584233
BR	8	17	96	0700	1349.17	21	78	50	411.227016	99	2.80336781	0.594653778	1.41584233
BR	8	18	96	0700	1349.10	21	78	50	411.20568	99	2.80336781	0.594653778	1.41584233
BR	8	19	96	0700	1349.07	21	78	50	411.196536	99	2.80336781	0.594653778	1.41584233
BR	8	20	96	0700	1348.94	21	78	50	411.156912	99	2.80336781	0.594653778	1.41584233
BR	8	21	96	0700	1348.87	16	77	50	411.135576	93	2.63346673	0.453069545	1.41584233
BR	8	22	96	0700	1348.80	16	77	50	411.11424	93	2.63346673	0.453069545	1.41584233
BR	8	23	96	0700	1348.72	16	77	50	411.089856	93	2.63346673	0.453069545	1.41584233
BR	8	24	96	0700	1348.65	15	76	50	411.06852	91	2.57683304	0.424752699	1.41584233
BR	8	25	96	0700	1348.57	15	76	50	411.044136	91	2.57683304	0.424752699	1.41584233
BR	8	26	96	0700	1348.51	15	76	50	411.0261528	91	2.57683304	0.424752699	1.41584233
BR	8	27	96	0700	1348.44	15	76	50	411.004512	91	2.57683304	0.424752699	1.41584233
BR	8	28	96	0700	1348.36			50	410.980128	0	0	0	1.41584233
BR	8	29	96	0700	1348.31			50	410.964888	0	0	0	1.41584233
BR	8	30	96	0700	1348.26			50	410.949648	0	0	0	1.41584233
BR	8	31	96	0700	1348.20			50	410.93136	0	0	0	1.41584233
BR	9	1	96	0700	1348.11			49	410.903928	0	0	0	1.387525483
BR	9	2	96	0700	1348.03			49	410.879544	0	0	0	1.387525483
BR	9	3	96	0700	1347.94			49	410.852112	0	0	0	1.387525483
BR	9	4	96	0700	1347.85			49	410.82468	0	0	0	1.387525483
BR	9	4	96	0730				95	0	0	0	0	0
BR	9	4	96	0800				218	0	0	0	0	0
BR	9	4	96	0830				334	0	0	0	0	0
BR	9	4	96	0900				402	0	0	0	0	0
BR	9	4	96	0930				496	0	0	0	0	0
BR	9	5	96	0700	1346.98			496	410.559504	0	0	0	14.04515591
BR	9	6	96	0700	1345.67			496	410.160216	0	0	0	14.04515591
BR	9	6	96	1100				548	0	0	0	0	0
BR	9	7	96	0700	1344.42			548	409.779216	0	0	0	15.51763193
BR	9	8	96	0700	1343.14			543	409.389072	0	0	0	15.3760477
BR	9	9	96	0700	1341.85			543	408.99588	0	0	0	15.3760477
BR	9	10	96	0700	1340.57			543	408.605736	0	0	0	15.3760477
BR	9	11	96	0700	1339.28	64		540	408.212544	64	1.81227818	0	15.29109716
BR	9	12	96	0700	1337.96	62		540	407.810208	62	1.75564449	0	15.29109716
BR	9	13	96	0700	1336.67	62		540	407.417016	62	1.75564449	0	15.29109716
BR	9	14	96	0700	1336.36	65		535	407.322528	65	1.84059503	0	15.14951293
BR	9	15	96	0700	1334.31			534	406.697688	0	0	0	15.12119608
BR	9	16	96	0700	1334.38			535	406.719024	0	0	0	15.14951293
BR	9	17	96	0700	1332.30			531	406.08504	0	0	0	15.03624554
BR	9	18	96	0700	1331.08	30	77	531	405.713184	107	3.02990259	0.849505398	15.03624554
BR	9	19	96	0700	1329.80	23	73	527	405.32304	96	2.71841727	0.651287472	14.92297815
BR	9	20	96	0700	1328.50	22	70	531	404.9268	92	2.60514989	0.622970625	15.03624554
BR	9	20	96	1000				594	0	0	0	0	0
BR	9	21	96	0700	1327.03	20	68	589	404.478744	88	2.4918825	0.566336932	16.67862264
BR	9	22	96	0700	1325.52	19	67	589	404.018496	86	2.43524881	0.538020085	16.67862264
BR	9	23	96	0700	1323.99	17	66	589	403.552152	83	2.35029827	0.481386392	16.67862264
BR	9	23	96	1000				646	0	0	0	0	0
BR	9	24	96	0700	1322.30	16	65	641	403.03704	81	2.29366457	0.453069545	18.15109867
BR	9	25	96	0700	1320.57	16	65	641	402.509736	81	2.29366457	0.453069545	18.15109867
BR	9	26	96	0700	1318.84	16	65	641	401.982432	81	2.29366457	0.453069545	18.15109867
BR	9	27	96	0700	1317.09	16	64	636	401.449032	80	2.26534773	0.453069545	18.00951443
BR	9	28	96	0700	1315.33	16	64	631	400.912584	80	2.26534773	0.453069545	17.8679302
BR	9	29	96	0700	1313.55	16	64	631	400.37004	80	2.26534773	0.453069545	17.8679302
BR	9	30	96	0700	1311.76	14	64	627	399.824448	78	2.20871403	0.396435852	17.75466281

Cougar Hydrology

RES	MO	DY	YR	POOL EL. (ft.)	OUTFLOW (cms)	INFLOW (cms)	MAX T (°F)	MIN T (°F)	Precip (in)
CR	1	1	96	1573.15	1.151	3.241	49	41	.09
CR	1	2	96	1573.00	1.640	1.582	50	37	.00
CR	1	3	96	1565.20	4.667	1.720	53	35	.33
CR	1	4	96	1557.70	4.866	2.125	50	38	.66
CR	1	5	96	1548.80	4.619	1.477	44	37	.14
CR	1	6	96	1541.75	4.182	1.775	44	38	.50
CR	1	7	96	1536.40	3.407	1.672	48	37	.11
CR	1	8	96	1537.30	2.477	2.772	48	40	1.85
CR	1	9	96	1536.45	2.480	2.202	53	42	.57
CR	1	10	96	1536.90	2.504	2.651	48	38	.87
CR	1	11	96	1536.45	2.114	1.967	49	33	.00
CR	1	12	96	1536.95	1.510	1.673	50	32	.00
CR	1	13	96	1537.40	1.111	1.259	51	30	.00
CR	1	14	96	1537.90	1.066	1.230	48	30	.00
CR	1	15	96	1539.71	1.072	1.673	48	36	1.39
CR	1	16	96	1541.60	1.533	2.166	50	42	1.40
CR	1	17	96	1541.00	1.926	1.724	44	34	.45
CR	1	18	96	1543.10	1.080	1.788	42	30	.04
CR	1	19	96	1547.00	1.099	2.430	45	31	2.27
CR	1	20	96	1549.30	1.108	1.904	44	35	.93
CR	1	21	96	1552.05	1.122	2.082	41	32	2.25
CR	1	22	96	1553.05	1.120	1.472	40	31	.30
CR	1	23	96	1553.60	1.120	1.315	39	31	.55
CR	1	24	96	1554.00	1.118	1.260	35	31	1.67
CR	1	25	96	1553.78	1.113	1.035	34	31	1.35
CR	1	26	96	1553.28	1.113	0.937	39	31	.45
CR	1	27	96	1553.15	1.117	1.071	38	31	.62
CR	1	28	96	1552.82	1.117	1.001	38	31	1.06
CR	1	29	96	1552.18	1.113	0.888	36	31	1.30
CR	1	30	96	1551.90	0.899	0.801	37	21	.18
CR	1	31	96	1552.10	0.746	0.816	37	16	.00
CR	2	1	96	1553.00	0.391	0.708	40	15	.00
CR	2	2	96	1554.20	0.304	0.729	42	12	.00
CR	2	3	96	1555.30	0.300	0.691	41	12	.00
CR	2	4	96	1556.80	0.306	0.842	39	20	.47
CR	2	5	96	1559.20	0.302	1.166	43	34	.18
CR	2	6	96	1573.45	0.330	5.650	44	35	2.02
CR	2	7	96	1606.59	0.303	14.000	46	38	3.13
CR	2	8	96	1624.65	0.300	8.581	53	39	.65
CR	2	9	96	1645.79	0.300	10.743	51	39	2.78
CR	2	10	96	1655.10	0.300	10.056	55	37	.00
CR	2	11	96	1655.50	2.673	2.887	52	35	.00
CR	2	12	96	1651.80	4.998	3.035	55	37	.00
CR	2	13	96	1650.88	5.693	5.209	56	37	.00
CR	2	14	96	1637.11	6.533	0.500	60	32	.00
CR	2	15	96	1628.55	6.477	2.288	60	32	.00
CR	2	16	96	1619.30	6.486	2.106	63	36	.00
CR	2	17	96	1611.20	6.479	2.771	58	37	.52
CR	2	18	96	1610.85	3.001	2.844	53	42	1.70
CR	2	19	96	1612.70	1.997	2.833	52	31	.82
CR	2	20	96	1612.55	2.198	2.130	50	35	.38
CR	2	21	96	1611.40	2.509	1.990	57	32	.80

Cougar Hydrology

CR	2	22	96	1609.50	2.342	1.489	42	32	.34
CR	2	23	96	1609.95	1.310	1.511	43	31	.73
CR	2	24	96	1610.36	1.038	1.222	35	31	1.12
CR	2	25	96	1610.55	1.032	1.118	42	25	.02
CR	2	26	96	1611.20	0.802	1.094	41	23	.00
CR	2	27	96	1612.15	0.504	0.933	42	21	.00
CR	2	28	96	1613.10	0.509	0.940	40	21	.00
CR	2	29	96	1614.00	0.373	0.782	45	26	.00
CR	3	1	96	1615.30	0.301	0.895	52	26	.00
CR	3	2	96	1616.45	0.302	0.830	52	27	.00
CR	3	3	96	1617.75	0.300	0.900	55	27	.16
CR	3	4	96	1619.60	0.307	1.166	52	37	.30
CR	3	5	96	1621.35	0.342	1.160	52	37	.82
CR	3	6	96	1622.67	0.499	1.120	48	37	.06
CR	3	7	96	1623.75	0.496	1.007	57	41	.00
CR	3	8	96	1624.97	0.491	1.070	57	41	.00
CR	3	9	96	1626.76	0.491	1.345	65	42	.00
CR	3	10	96	1628.91	0.490	1.523	69	46	.00
CR	3	11	96	1631.45	0.492	1.724	55	45	.40
CR	3	12	96	1633.45	0.834	1.812	52	42	.40
CR	3	13	96	1634.55	1.019	1.560	55	39	.00
CR	3	14	96	1634.95	1.020	1.217	61	35	.00
CR	3	15	96	1635.80	0.750	1.170	69	33	.00
CR	3	16	96	1637.10	0.484	1.129	59	29	.00
CR	3	17	96	1638.10	0.486	0.984	64	29	.00
CR	3	18	96	1639.35	0.380	1.006	67	35	.00
CR	3	19	96	1640.60	0.300	0.928	76	39	.03
CR	3	20	96	1641.87	0.300	0.942	57	37	.02
CR	3	21	96	1643.03	0.300	0.889	60	32	.00
CR	3	22	96	1644.41	0.300	1.004	62	31	.59
CR	3	23	96	1645.63	0.300	0.926	46	36	.17
CR	3	24	96	1646.67	0.300	0.836	51	37	.03
CR	3	25	96	1647.57	0.303	0.768	50	26	.00
CR	3	26	96	1648.50	0.300	0.783	58	26	.00
CR	3	27	96	1649.26	0.300	0.696	61	27	.00
CR	3	28	96	1650.10	0.304	0.743	65	32	.30
CR	3	29	96	1650.80	0.303	0.670	50	32	.02
CR	3	30	96	1651.55	0.302	0.697	49	35	.07
CR	3	31	96	1652.45	0.301	0.776	55	35	.31
CR	4	1	96	1654.85	0.302	1.575	50	42	1.98
CR	4	2	96	1657.26	0.300	1.592	59	42	.70
CR	4	3	96	1659.00	0.487	1.427	50	40	.16
CR	4	4	96	1659.85	0.687	1.149	60	34	.00
CR	4	5	96	1660.95	0.457	1.056	70	34	.00
CR	4	6	96	1662.39	0.300	1.090	77	42	.00
CR	4	7	96	1663.87	0.300	1.116	80	45	.00
CR	4	8	96	1665.50	0.362	1.267	82	47	.00
CR	4	9	96	1667.02	0.444	1.292	80	49	.06
CR	4	10	96	1668.50	0.441	1.274	55	43	.22
CR	4	11	96	1669.40	0.673	1.181	51	41	.25
CR	4	12	96	1670.05	0.848	1.217	50	38	.92
CR	4	13	96	1670.35	0.850	1.021	45	37	.70
CR	4	14	96	1670.70	0.850	1.049	62	36	.00

Cougar Hydrology

CR	4	15	96	1671.00	0.842	1.013	75	42	.00
CR	4	16	96	1671.75	0.859	1.288	65	44	.29
CR	4	17	96	1672.12	0.861	1.073	51	34	.77
CR	4	18	96	1672.42	0.894	1.066	48	34	.31
CR	4	19	96	1672.60	0.900	1.004	50	35	.31
CR	4	20	96	1672.70	0.909	0.966	48	35	.42
CR	4	21	96	1672.95	0.850	0.994	51	35	.40
CR	4	22	96	1673.70	0.791	1.223	52	36	.61
CR	4	23	96	1675.53	1.273	2.331	51	44	1.07
CR	4	24	96	1682.20	1.041	4.966	60	42	2.11
CR	4	25	96	1684.35	2.560	3.849	51	41	.66
CR	4	26	96	1684.20	2.897	2.807	64	42	.46
CR	4	27	96	1684.10	2.111	2.051	59	32	.00
CR	4	28	96	1684.25	1.386	1.477	60	35	.00
CR	4	29	96	1684.80	1.171	1.503	75	37	.00
CR	4	30	96	1685.45	0.882	1.275	74	40	.00
CR	5	1	96	1685.72	1.099	1.263	72	40	.03
CR	5	2	96	1685.66	1.206	1.170	72	42	.03
CR	5	3	96	1685.56	1.037	0.977	55	36	.09
CR	5	4	96	1685.68	0.893	0.966	48	36	.12
CR	5	5	96	1686.16	0.566	0.857	63	36	.00
CR	5	6	96	1687.07	0.300	0.853	63	33	.00
CR	5	7	96	1687.90	0.301	0.808	66	33	.00
CR	5	8	96	1688.65	0.300	0.760	60	35	.00
CR	5	9	96	1689.35	0.300	0.730	61	30	.00
CR	5	10	96	1689.75	0.401	0.647	64	30	.00
CR	5	11	96	1689.69	0.672	0.635	71	38	.00
CR	5	12	96	1689.68	0.673	0.667	81	50	.00
CR	5	13	96	1689.72	0.744	0.769	83	53	.12
CR	5	14	96	1689.85	1.114	1.194	61	53	1.27
CR	5	15	96	1690.80	2.392	2.980	61	50	1.46
CR	5	16	96	1690.95	3.002	3.095	59	46	1.01
CR	5	17	96	1690.50	2.617	2.339	68	47	.60
CR	5	18	96	1690.45	2.946	2.915	59	44	1.14
CR	5	19	96	1690.25	2.870	2.746	58	43	1.00
CR	5	20	96	1689.90	2.457	2.241	59	43	.14
CR	5	21	96	1689.65	1.974	1.820	65	42	.12
CR	5	22	96	1690.20	2.342	2.681	56	41	1.01
CR	5	23	96	1690.10	2.524	2.463	52	41	.82
CR	5	24	96	1690.00	2.264	2.202	59	42	.12
CR	5	25	96	1690.10	1.824	1.886	75	42	.00
CR	5	26	96	1690.00	1.613	1.551	80	43	.00
CR	5	27	96	1689.95	1.333	1.302	69	42	.00
CR	5	28	96	1690.30	0.962	1.179	63	43	.00
CR	5	29	96	1690.57	0.891	1.058	59	42	.05
CR	5	30	96	1690.70	0.890	0.971	63	43	.00
CR	5	31	96	1690.68	0.890	0.878	66	40	.00
CR	6	1	96	1690.62	0.834	0.797	74	39	.00
CR	6	2	96	1690.75	0.640	0.721	86	51	.00
CR	6	3	96	1690.98	0.611	0.753	95	56	.00
CR	6	4	96	1691.10	0.622	0.697	83	54	.00
CR	6	5	96	1691.20	0.622	0.684	73	46	.00
CR	6	6	96	1691.22	0.619	0.632	88	43	.00

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CR	6	7	96	1691.19	0.594	0.576	90	50	.00
CR	6	8	96	1691.22	0.553	0.572	80	50	.00
CR	6	9	96	1691.24	0.540	0.553	75	51	.00
CR	6	10	96	1691.25	0.550	0.557	68	42	.00
CR	6	11	96	1691.24	0.518	0.512	77	42	.00
CR	6	12	96	1691.24	0.499	0.499	78	44	.00
CR	6	13	96	1691.30	0.408	0.446	82	44	.00
CR	6	14	96	1691.45	0.400	0.493	75	43	.00
CR	6	15	96	1691.57	0.400	0.475	80	45	.00
CR	6	16	96	1691.69	0.400	0.475	75	45	.00
CR	6	17	96	1691.75	0.400	0.408	66	43	.00
CR	6	18	96	1691.87	0.429	0.504	61	42	.36
CR	6	19	96	1697.81	0.440	0.403	68	41	.00
CR	6	20	96	1691.75	0.440	0.403	84	40	.00
CR	6	21	96	1691.72	0.420	0.401	78	45	.00
CR	6	22	96	1691.65	0.429	0.386	72	44	.00
CR	6	23	96	1691.68	0.428	0.447	73	45	.19
CR	6	24	96	1691.68	0.532	0.532	60	50	.90
CR	6	25	96	1691.40	0.590	0.416	62	48	.57
CR	6	26	96	1691.12	0.597	0.423	70	47	.06
CR	6	27	96	1690.86	0.597	0.436	77	41	.06
CR	6	28	96	1690.68	0.554	0.443	65	50	.20
CR	6	29	96	1690.53	0.503	0.411	70	45	.00
CR	6	30	96	1690.35	0.500	0.389	81	46	.00
CR	7	1	96	1690.28	0.418	0.375	86	48	.00
CR	7	2	96	1690.22	0.406	0.369	92	47	.00
CR	7	3	96	1696.15	0.406	0.363	88	52	.00
CR	7	4	96	1690.11	0.401	0.436	80	52	.00
CR	7	5	96	1690.04	0.407	0.364	70	41	.00
CR	7	6	96	1689.94	0.408	0.346	81	40	.00
CR	7	7	96	1689.85	0.404	0.349	94	45	.00
CR	7	8	96	1689.73	0.404	0.331	98	54	.00
CR	7	9	96	1689.64	0.401	0.346	90	54	.00
CR	7	10	96	1689.60	0.400	0.339	80	47	.00
CR	7	11	96	1689.45	0.397	0.342	89	47	.00
CR	7	12	96	1689.35	0.398	0.337	93	51	.00
CR	7	13	96	1689.22	0.399	0.319	99	56	.00
CR	7	14	96	1689.11	0.399	0.331	105	63	.00
CR	7	15	96	1689.00	0.400	0.333	99	60	.00
CR	7	16	96	1688.73	0.553	0.388	90	50	.00
CR	7	17	96	1688.66	0.406	0.363	81	49	.00
CR	7	18	96	1688.55			61	48	.40
CR	7	19	96	1688.39	0.400	0.302	65	47	.06
CR	7	20	96	1688.25	0.400	0.315	45	45	.00
CR	7	21	96	1688.13	0.400	0.326	82	45	.00
CR	7	22	96	1687.98	0.400	0.309	91	50	.00
CR	7	23	96	1687.83	0.400	0.308	101	60	.00
CR	7	24	96	1687.67	0.400	0.303	101	61	.00
CR	7	25	96	1687.50	0.400	0.297	98	58	.00
CR	7	26	96	1687.33	0.400	0.296	100	59	.00
CR	7	27	96	1687.15	0.400	0.290	100	60	.00
CR	7	28	96	1686.99	0.400	0.303	96	61	.00
CR	7	29	96	1686.83	0.400	0.303	77	56	.00

Cougar Hydrology

CR	7	30	96	1686.65	0.400	0.291	95	56	.00
CR	7	31	96	1686.46	0.400	0.285	95	52	.00
CR	8	1	96	1685.88	0.552	0.200	91	49	.00
CR	8	2	96	1684.55	0.888	0.084	82	48	.00
CR	8	3	96	1683.80	0.890	0.439	65	51	.14
CR	8	4	96	1682.75	0.890	0.261	72	47	.00
CR	8	5	96	1681.70	0.899	0.273	78	49	.00
CR	8	6	96	1680.55	0.876	0.193	70	41	.00
CR	8	7	96	1679.47	0.841	0.203	87	41	.00
CR	8	8	96	1678.37	0.840	0.193	98	53	.00
CR	8	9	96	1677.24	0.843	0.181	97	53	.00
CR	8	10	96	1676.11	0.844	0.185	102	61	.00
CR	8	11	96	1674.99	0.851	0.201	101	54	.00
CR	8	12	96	1673.83	0.856	0.186	83	48	.00
CR	8	13	96	1672.69	0.851	0.196	97	54	.00
CR	8	14	96	1671.49	0.861	0.175	99	55	.00
CR	8	15	96	1670.30	0.876	0.199	91	51	.00
CR	8	16	96	1669.00	0.878	0.141	90	48	.00
CR	8	17	96	1667.84	0.871	0.218	87	48	.00
CR	8	18	96	1666.60	0.870	0.175	75	43	.00
CR	8	19	96	1665.20	0.874	0.094	77	44	.00
CR	8	20	96	1664.09	0.878	0.262	78	44	.00
CR	8	21	96	1662.85	0.880	0.196	79	45	.00
CR	8	22	96	1661.57	0.876	0.173	87	45	.00
CR	8	23	96	1660.29	0.888	0.189	97	48	.00
CR	8	24	96	1658.98	0.893	0.181	102	57	.00
CR	8	25	96	1657.65	0.897	0.179	101	59	.00
CR	8	26	96	1656.31	0.898	0.178	81	58	.00
CR	8	27	96	1655.01	0.897	0.202	77	54	.28
CR	8	28	96	1654.55	0.896	0.651	71	48	.00
CR	8	29	96	1652.33	0.897	0.252		48	.00
CR	8	30	96	1650.90	0.903	0.150	97	54	.00
CR	8	31	96	1649.50	0.908	0.176	78	52	.00
CR	9	1	96	1648.10	0.907	0.178	79	44	.00
CR	9	2	96	1646.65	0.900	0.150	82	44	.00
CR	9	3	96	1645.25	0.901	0.181	80	44	.00
CR	9	4	96	1644.00	0.783	0.143	74	45	.00
CR	9	5	96	1643.06	0.702	0.223	68	47	.04
CR	9	6	96	1642.02	0.698	0.170	69	38	.00
CR	9	7	96	1641.00	0.700	0.185	77	38	.00
CR	9	8	96	1639.95	0.700	0.172	82	44	.00
CR	9	9	96	1638.91	0.700	0.179	85	45	.00
CR	9	10	96	1637.80	0.713	0.159	85	47	.00
CR	9	11	96	1636.73	0.702	0.170	94	49	.00
CR	9	12	96	1635.70	0.701	0.191	85	51	.00
CR	9	13	96	1634.60	0.699	0.156	67	46	.00
CR	9	14	96	1633.55	0.700	0.180	62	47	.15
CR	9	15	96	1633.15	0.700	0.504	63	50	1.32
CR	9	16	96	1632.50	0.702	0.385	60	47	1.04
CR	9	17	96	1631.75	0.703	0.337	58	48	.45
CR	9	18	96	1630.73	0.700	0.204	65	39	.00
CR	9	19	96	1629.77	0.700	0.235	67	38	.04
CR	9	20	96	1628.71	0.700	0.188	64	42	.01

Cougar Hydrology

CR	9	21	96	1627.66	0.700	0.195	65	36	.00
CR	9	22	96	1626.60	0.707	0.199	65	36	.03
CR	9	23	96	1625.47	0.710	0.171	65	39	.00
CR	9	24	96	1624.15	0.704	0.077	76	40	.00
CR	9	25	96	1623.05	0.700	0.180	74	39	.00
CR	9	26	96	1622.10	0.707	0.260	78	39	.00
CR	9	27	96	1621.00	0.700	0.124	84	41	.00
CR	9	28	96	1619.90	0.700	0.186	85	42	.00
CR	9	29	96	1618.75	0.700	0.165	87	45	.00
CR	9	30	96	1617.40	0.803	0.178	86	46	.00

APPENDIX D

PHYTOPIGMENT DATA FOR BLUE RIVER AND COUGAR PROJECTS

Note: Data are from analyses of samples collected and analyzed using the pheophytin-corrected and the trichromatic method after extraction with organic solvent. The data listed are the calculated concentrations based on spectrophotometric absorbances and the above methods. Negative values may be encountered and these may be interpreted as absence of the noted pigment.

BLUE RIVER LAKE PHYTOPIGMENT DATA

Date	Depth	Chlorophyll a (corr)	Pheophytin	Chlorophyll a (tri)	Chlorophyll b	Chlorophyll c
Apr 16, 96	0	0.427	0.113	0.717	0.063	0.229
Apr 16, 96	6	0.174	0.113	0.481	0.081	0.286
Apr 16, 96	10	0.32	-0.204	0.344	0.081	0.259
Apr 16, 96	20	0.013	0.045	0.274	0.294	0.481
Apr 16, 96	30	0.053	-0.045	0.334	0.486	0.869
Apr 16, 96	40	-0.147	-0.204	0.21	0.427	0.696
Apr 16, 96	50	-0.107	-0.136	0.158	0.054	0.246
May 28, 96	0	1.669	0.113	1.843	-0.03	0.214
May 28, 96	6	1.615	-0.136	1.785	-0.096	0.175
May 28, 96	10	1.682	0.136	1.942	-0.073	0.257
May 28, 96	20	0.894	0.227	1.268	-0.04	0.118
May 28, 96	30	0.494	0.182	0.657	-0.017	0.068
May 28, 96	40	0.454	0.091	0.594	0.04	0.172
May 28, 96	50	0.32	-0.113	0.469	0.101	0.247
May 28, 96	60	0.267	0.068	0.518	0.12	0.306
Jul 9, 96	0	1.001	0.227	1.395	-0.065	0.158
Jul 9, 96	7.5	3.564	0.477	4.211	-0.215	0.367
Jul 9, 96	10	8.964	0.681	9.949	-0.656	1.037
Jul 9, 96	20	0.347	-0.068	0.557	0.087	0.083
Jul 9, 96	30	0.107	-0.159	0.203	0.018	0.117
Jul 9, 96	40	0.013	-0.113	0.145	0.024	0.133
Jul 9, 96	50	-0.107	-0.091	0.126	-0.012	0.012
Jul 9, 96	60	-0.214	0	0.141	0.012	0.08
Aug 26, 96	0	0.894	-0.227	1.05	0.035	0.205
Aug 26, 96	10	0.574	-0.045	0.89	-0.031	0.164
Aug 26, 96	20	1.308	0.068	1.722	0.028	0.382
Aug 26, 96	30	0.521	-0.068	0.61	-0.025	0.168
Aug 26, 96	40	0.147	0.068	0.217	-0.097	0.121
Aug 26, 96	50	0.013	-0.113	0.028	-0.14	-0.002
Aug 26, 96	60	0.04	0.068	0.176	0.076	0.056
Sep 23, 96	0	1.255	-0.045	1.398	0.029	0.261
Sep 23, 96	10	1.375	-0.091	1.604	-0.052	0.286
Sep 23, 96	20	0.387	0.091	0.619	0.006	0.2
Sep 23, 96	30	0.254	0.091	0.381	-0.065	0.01
Sep 23, 96	40	0.227	-0.182	0.297	-0.028	0.128
Sep 23, 96	50	0.254	-0.159	0.363	-0.06	0.131

COUGAR LAKE PHYTOPIGMENT DATA

Date	Depth (m)	Chlorophyll a (corr)	Pheophytin	Chlorophyll a (tri)	Chlorophyll b	Chlorophyll c
Apr 17, 96	0	0.481	0.045	0.693	0.091	0.168
Apr 17, 96	10	1.028	0.499	1.54	0.092	0.403
Apr 17, 96	20	0.32	-0.182	0.53	-0.011	0.118
Apr 17, 96	30	0.04	-0.023	0.183	-0.013	0.041
Apr 17, 96	40	0.053	-0.091	0.113	-0.009	0.12
Apr 17, 96	50	-0.08	0.136	0.087	0.046	0.096
Apr 17, 96	60	-0.12	0.159	0.158	0.249	0.417
Apr 17, 96	70	0	-0.023	0.152	0.186	0.397
Apr 17, 96	80	-0.04	0.023	0.073	0.126	0.222
Apr 17, 96	90	-0.093	-0.227	0.204	0.316	0.494
Apr 17, 96	100	-0.067	-0.182	0.297	0.467	0.759
May 29, 96	0	15.052	0.936	16.024	-0.657	1.332
May 29, 96	6	7.383	0.159	8.108	-0.005	0.869
May 29, 96	10	2.937	0.409	3.633	0.03	0.362
May 29, 96	20	0.294	0.023	0.445	-0.008	0.014
May 29, 96	30	0.134	-0.113	0.21	0.002	0.05
May 29, 96	40	0.067	-0.113	0.215	0.079	0.124
May 29, 96	50	0.027	-0.091	0.196	0.039	0.04
May 29, 96	60	0.027	0.136	0.21	0.105	0.351
May 29, 96	70	-0.027	-0.023	0.113	0.144	0.155
May 29, 96	80	-0.16	0.091	0.183	0.28	0.562
May 29, 96	90	0	0.068	0.212	0.227	0.385
May 29, 96	100	0.12	-0.182	0.252	0.28	0.528
Jul 10, 96	0	0.868	0.045	1.138	0.004	0.189
Jul 10, 96	10	6.101	0.613	6.812	-0.326	0.699
Jul 10, 96	20	0.961	0.477	1.568	-0.033	0.266
Jul 10, 96	30	0.227	0.068	0.494	0.02	0.082
Jul 10, 96	40	0.24	-0.204	0.358	0.005	0.096
Jul 10, 96	50	0.134	0.204	0.426	0.012	0.095
Jul 10, 96	60	-0.08	0	0.309	0.105	0.19
Jul 10, 96	70	-0.16	0.136	0.137	0.066	0.049
Jul 10, 96	80	-0.12	-0.068	0.268	0.107	0.261
Jul 10, 96	90	-0.187	-0.091	0.264	0.216	0.349
Jul 10, 96	100	-0.107	0.182	0.209	0.059	0.239
Jul 10, 96	110	0.28	-0.091	0.599	0.179	0.305

Aug 27, 96	0	1.108	-0.045	1.343	0.08	0.212
Aug 27, 96	6	0.881	-0.159	1.151	-0.013	0.203
Aug 27, 96	10	0.788	-0.091	0.924	0.105	0.289
Aug 27, 96	20	0.854	0.272	1.269	0.195	0.461
Aug 27, 96	30	0.307	0.113	0.72	0.019	0.269
Aug 27, 96	40	0.227	-0.272	0.263	-0.016	0.075
Aug 27, 96	50	0.093	-0.159	0.084	-0.063	0.033
Aug 27, 96	60	-0.027	0.136	0.02	-0.097	-0.086
Aug 27, 96	70	0.107	0.159	0.058	-0.023	0.049
Aug 27, 96	80	0.053	0.182	0.058	-0.021	0.025
Aug 27, 96	90	-0.013	0.045	0.06	-0.039	0.008
Aug 27, 96	100	0	0.068	0.124	0.011	0.074
Sep 25, 96	0	0.174	-0.023	0.359	-0.057	-0.057
Sep 25, 96	10	0.627	-0.113	0.675	-0.033	0.045
Sep 25, 96	20	0.227	0.159	0.486	-0.101	0.061
Sep 25, 96	30	0.013	-0.25	0.112	-0.103	-0.078
Sep 25, 96	40	0.027	-0.227	0.09	-0.071	0.081
Sep 25, 96	50	-0.053	0.113	0.015	-0.046	0.001
Sep 25, 96	60	-0.013	-0.34	0.021	-0.121	-0.054
Sep 25, 96	70	-0.067	-0.023	0.044	0.007	0.101
Sep 25, 96	80	-0.013	0.159	0.08	0.038	0.195
Sep 25, 96	90	0.013	-0.295	0.1	0.013	0.163

STREAM PHYTOPIGMENTS

Station	Date	Chlorophyll a (corr)	Pheophytin	Chlorophyll a (tri)	Chlorophyll b	Chlorophyll c
BR-IN	Apr 18, 96	-0.147	-0.204	0.21	0.427	0.696
BR-IN	May 27, 96	0.254	-0.068	0.174	0.008	0.153
BR-IN	Jul 8, 96	0.053	0.045	0.112	-0.12	-0.013
BR-IN	Aug 28, 96	0.147	-0.454	0.136	-0.133	0.008
BR-IN	Sep 26, 96	-0.147	-0.068	0.037	-0.182	-0.012
LC	Apr 18, 96	0.214	-0.454	0.014	-0.03	-0.052
LC	May 27, 96	0.267	0.068	0.518	0.12	0.306
LC	Jul 8, 96	-0.067	0.113	0.054	-0.099	-0.038
LC	Aug 28, 96	0	-0.113	0.08	-0.05	0.287
LC	Sep 26, 96	0	0.068	0.079	-0.144	0.089
SF-IN	Apr 18, 96	0.147	-0.068	0.46	0.079	0.129
SF-IN	May 27, 96	0.174	0	0.333	0.026	0.095
SF-IN	Jul 8, 96	-0.027	-0.25	0.09	-0.054	0.016
SF-IN	Aug 28, 96	0.107	0.045	0.15	-0.003	0.352
SF-IN	Sep 26, 96	0.053	-0.113	0.118	-0.125	0.011
BR-OUT	Apr 18, 96	-0.107	-0.136	0.158	0.054	0.246
BR-OUT	May 27, 96	0.214	0	0.482	0.13	0.372
BR-OUT	Jul 8, 96	-0.053	-0.182	0.159	-0.021	0.216
BR-OUT	Aug 28, 96	0.401	-0.091	0.363	-0.003	0.238
BR-OUT	Sep 26, 96	0.134	0.113	0.428	-0.036	0.254
SF-OUT	Apr 18, 96	0.147	-0.113	0.194	0.037	0.241
SF-OUT	May 27, 96	-0.107	0.023	0.239	-0.005	0.079
SF-OUT	Jul 8, 96	0.267	-0.136	0.389	0.048	0.105
SF-OUT	Aug 28, 96	0.227	-0.091	0.429	0.063	0.497
SF-OUT	Sep 26, 96	0.04	0.068	0.267	-0.057	-0.016
MR-UP	Apr 18, 96	-0.067	0.159	0.426	0.067	0.215
MR-UP	May 27, 96	-0.027	0.023	0.255	0.021	0.04
MR-UP	Jul 9, 96	0.067	-0.045	0.332	0.047	0.088
MR-UP	Aug 28, 96	0.36	-0.295	0.387	0.038	0.285
MR-UP	Sep 24, 96	0.401	0	0.469	-0.05	0.199
MR-FR	Apr 18, 96	0.427	0.068	0.69	0.176	0.288
MR-FR	May 27, 96	0.027	-0.227	0.262	0	0.023
MR-FR	Jul 9, 96	0.067	0.159	0.386	0.087	0.114
MR-FR	Aug 28, 96	0.334	-0.023	0.447	0.02	0.191
MR-FR	Sep 24, 96	0.481	-0.113	0.718	-0.021	0.191

MR-LD	Apr 18, 96	0.16	-0.091	0.359	0.284	0.563
MR-LD	May 27, 96	0.174	-0.045	0.404	0.011	0.02
MR-LD	Jul 9, 96	-0.147	0.295	-0.028	-0.065	-0.083
MR-LD	Aug 28, 96	0.427	-0.227	0.706	0.113	0.355
MR-LD	Sep 24, 96	0.147	-0.091	0.582	-0.097	0.146
MR-GS	Apr 18, 96	0.441	0.182	0.849	0.107	0.323
MR-GS	May 27, 96	0.12	-0.182	0.252	0.28	0.528
MR-GS	Jul 9, 96	0.307	0.272	0.568	0.02	0.117
MR-GS	Aug 26, 96	0.481	0.113	0.559	0.022	0.307
MR-GS	Sep 24, 96	0.347	0.136	0.556	-0.048	0.077
MR-HB	Apr 18, 96	0.187	0.182	0.593	0.114	0.214
MR-HB	May 27, 96	0.334	0.159	0.597	0.067	0.184
MR-HB	Jul 9, 96	-0.214	0	0.141	0.012	0.08
MR-HB	Aug 26, 96	0.414	0	0.682	-0.057	0.146
MR-HB	Sep 26, 96	0.134	-0.023	0.482	-0.178	-0.014

APPENDIX E

PHYTOPLANKTON DATA FOR BLUE RIVER AND COUGAR PROJECTS

Phytoplankton Population Data for Blue River and Cougar Lakes, 1996 (cells/ml)

Lake	Month	Depth (m)	April	May	July	August	September
BR	4	0	3167.0625	8598.45	5735.625	4588.5	5097.225
BR	4	10	877.8	22743	5246.85	4239.375	4189.5
BR	4	20	137.15625	4004.9625	3112.2	5765.55	2074.8
BR	4	30	52.36875	301.74375	1605.975	623.4375	820.44375
BR	4	40	0	0	1271.8125	0	0
BR	4	50	0	0	64.8375	0	0
BR	4	60	0	0	159.6	0	0

Lake	Month	Depth (m)	April	May	July	August	September
CR	4	0	2932.65	48438.6	5456.325	2423.925	2428.9125
CR	4	10	4957.575	8618.4	17416.35	1855.35	1620.9375
CR	4	20	2044.875	850.36875	4189.5	1745.625	668.325
CR	4	30	324.1875	139.65	264.3375	147.13125	169.575
CR	4	40	0	104.7375	229.425	67.33125	79.8
CR	4	50	0	49.875	77.30625	59.85	57.35625
CR	4	60	0	87.28125	117.20625	29.925	34.9125
CR	4	70	0	64.8375	49.875	0	134.6625
CR	4	80	0	29.925	0	0	0
CR	4	90	0	69.825	0	0	0
CR	4	100	0	74.8125	0	0	0

APPENDIX F

SELECT INPUT OUTPUT FILES FOR COUGAR LAKE PREDICTIONS


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11000  ***COUGAR LAKE MAY 1996 SELECT
1010   ***DATA SETS  01
1020   ***PRINT INPUT
1030   ***INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR
1040   ***ENGLISH
1050   ***TABLE      01
1060   ***THICKNESS  5.0
1070   ***INTERVAL  01
1080   ***SURFACE    400.6
1090   ***BOTTOM     0.0
1100   ***WEIR
1110   ***SUBMERGED
1120   ***LENGTH    100.
1130   ***HEIGHT     155.0
1140   ***FLOW       31.5
1150   ***NUMBER OF TEMP      41
1160   ***TEMPERATURE DEGREES CENTIGRADE
1170   ***HEIGHT  TEMP
1180   ***    400.6  14.8
1190   ***    394.0  13.8
1200   ***    387.4  13.1
1210   ***    380.9  11.1
1220   ***    374.3  10.3
1230   ***    367.8   9.9
1240   ***    361.2   9.6
1250   ***    354.6   9.2
1260   ***    348.1   9.1
1270   ***    341.5   9.0
1280   ***    335.0   8.7
1290   ***    328.4   8.6
1300   ***    321.8   8.4
1310   ***    315.3   8.2
1320   ***    308.7   8.1
1330   ***    302.1   8.0
1340   ***    295.6   8.0
1350   ***    289.0   7.9
1360   ***    282.5   7.8
1370   ***    275.9   7.7
1380   ***    269.3   7.7
1390   ***    262.8   7.5
1400   ***    256.2   7.1
1410   ***    249.7   6.8
1420   ***    243.1   6.7
1430   ***    236.5   6.4
1440   ***    230.0   6.1
1450   ***    223.4   5.6
1460   ***    216.8   5.3
1470   ***    210.3   5.2
1480   ***    203.7   5.1
1490   ***    197.2   5.0
1500   ***    190.6   4.9
1510   ***    184.0   4.9
1520   ***    177.5   4.9
1530   ***    170.9   4.8

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1540	***	151.2	4.8
1550	***	125.0	4.7
1560	***	72.5	4.7
1570	***	40.0	4.7
1580	***	20.0	4.7
1590	***	QUALITIES	1
1600	***	NUMBER OF DISSOLVED OXYGEN	41
1610	***	HEIGHT	DISSOLVED OXYGEN
1620	***	400.6	12.3
1630	***	394.0	12.4
1640	***	387.4	12.8
1650	***	380.9	11.8
1660	***	374.3	11.3
1670	***	367.8	11.4
1680	***	361.2	11.4
1690	***	354.6	11.1
1700	***	348.1	11.3
1710	***	341.5	11.2
1720	***	335.0	11.2
1730	***	328.4	11.1
1740	***	321.8	11.2
1750	***	315.3	11.2
1760	***	308.7	11.2
1770	***	302.1	11.2
1780	***	295.6	11.2
1790	***	289.0	11.2
1800	***	282.5	11.2
1810	***	275.9	11.3
1820	***	269.3	11.3
1830	***	262.8	11.3
1840	***	256.2	11.3
1850	***	249.7	11.3
1860	***	243.1	11.3
1870	***	236.5	11.3
1880	***	230.0	11.2
1890	***	223.4	11.0
1900	***	216.8	10.9
1910	***	210.3	10.9
1920	***	203.7	10.9
1930	***	197.2	10.9
1940	***	190.6	10.9
1950	***	184.0	10.9
1960	***	177.5	10.9
1970	***	170.9	10.8
1980	***	151.2	10.9
1990	***	125.0	10.8
2000	***	72.5	10.1
2010	***	40.0	9.3
2020	***	20.0	9.0
2030	***	STOP	

COUGAR LAKE MAY 29, 1996 SELECT

INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR
UNITS ARE IN FEET

WEIR CREST ELEVATION 155.000
WEIR LENGTH 100.000
DISCHARGE, VOLUME FLOW PER SEC. 31.0000

TOTAL DISCHARGE, VOLUME PER SEC 31.0000

LOWER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM 151.670
ELEVATION 151.670
LOWER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM 151.670
ELEVATION 151.670
UPPER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM 400.600
ELEVATION 400.600
UPPER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM 400.600
ELEVATION 400.600

OUTFLOW DENSITY 0.99989 G/CC

OUTFLOW TEMPERATURE 7.31

OUTFLOW CONCENTRATION OF DISSOLVED OXYGEN 11.18

Elevation	Depth	Density	Norm.Vel.	Flow	Temperature	Dis. Oxygen
400.300	0.30	0.99917	0.0000	0.0000	14.75	12.30
397.500	3.10	0.99923	0.1768	0.1160	14.33	12.35
392.500	8.10	0.99932	0.3943	0.2588	13.64	12.49
387.500	13.10	0.99939	0.5331	0.3498	13.11	12.79
382.500	18.10	0.99957	0.7796	0.5116	11.59	12.05
377.500	23.10	0.99966	0.8716	0.5720	10.69	11.54
372.500	28.10	0.99971	0.9095	0.5968	10.19	11.33
367.500	33.10	0.99974	0.9291	0.6097	9.89	11.40
362.500	38.10	0.99976	0.9422	0.6182	9.66	11.40
357.500	43.10	0.99978	0.9551	0.6267	9.38	11.23
352.500	48.10	0.99980	0.9635	0.6322	9.17	11.16
347.500	53.10	0.99980	0.9673	0.6347	9.09	11.29
342.500	58.10	0.99981	0.9707	0.6370	9.02	11.22
337.500	63.10	0.99982	0.9764	0.6407	8.82	11.20
332.500	68.10	0.99983	0.9804	0.6433	8.66	11.16
327.500	73.10	0.99984	0.9829	0.6449	8.57	11.11
322.500	78.10	0.99985	0.9859	0.6469	8.42	11.19
317.500	83.10	0.99986	0.9885	0.6486	8.27	11.20
312.500	88.10	0.99987	0.9903	0.6498	8.16	11.20
307.500	93.10	0.99987	0.9915	0.6506	8.08	11.20
302.500	98.10	0.99988	0.9926	0.6514	8.01	11.20
297.500	103.10	0.99988	0.9932	0.6517	8.00	11.20
292.500	108.10	0.99988	0.9939	0.6522	7.95	11.20
287.500	113.10	0.99988	0.9948	0.6528	7.88	11.20
282.500	118.10	0.99989	0.9955	0.6533	7.80	11.20
277.500	123.10	0.99989	0.9962	0.6537	7.72	11.28
272.500	128.10	0.99989	0.9966	0.6540	7.70	11.30
267.500	133.10	0.99990	0.9971	0.6543	7.64	11.30
262.500	138.10	0.99991	0.9978	0.6547	7.48	11.30
257.500	143.10	0.99992	0.9986	0.6553	7.18	11.30
252.500	148.10	0.99993	0.9991	0.6556	6.93	11.30

247.500	153.10	0.99994	0.9994	0.6558	6.77	11.30
242.500	158.10	0.99994	0.9995	0.6559	6.67	11.30
237.500	163.10	0.99995	0.9997	0.6560	6.45	11.30
232.500	168.10	0.99996	0.9998	0.6561	6.22	11.24
227.500	173.10	0.99997	0.9999	0.6561	5.91	11.12
222.500	178.10	0.99998	1.0000	0.6562	5.56	10.99
217.500	183.10	0.99999	1.0000	0.6562	5.33	10.91
212.500	188.10	0.99999	1.0000	0.6562	5.23	10.90
207.500	193.10	0.99999	1.0000	0.6562	5.16	10.90
202.500	198.10	0.99999	1.0000	0.6562	5.08	10.90
197.500	203.10	0.99999	1.0000	0.6562	5.00	10.90
192.500	208.10	0.99999	1.0000	0.6562	4.93	10.90
187.500	213.10	0.99999	1.0000	0.6562	4.90	10.90
182.500	218.10	0.99999	1.0000	0.6562	4.90	10.90
177.500	223.10	0.99999	1.0000	0.6562	4.90	10.90
172.500	228.10	0.99999	1.0000	0.6562	4.82	10.82
167.500	233.10	0.99999	1.0000	0.6562	4.80	10.82
162.500	238.10	0.99999	1.0000	0.6562	4.80	10.84
157.500	243.10	0.99999	1.0000	0.6562	4.80	10.87
152.500	248.10	0.99999	1.0000	0.6562	4.80	10.89
147.500	253.10	0.99999	0.0000	0.0000	4.79	10.89
142.500	258.10	1.00000	0.0000	0.0000	4.77	10.87
137.500	263.10	1.00000	0.0000	0.0000	4.75	10.85
132.500	268.10	1.00000	0.0000	0.0000	4.73	10.83
127.500	273.10	1.00000	0.0000	0.0000	4.71	10.81
122.500	278.10	1.00000	0.0000	0.0000	4.70	10.77
117.500	283.10	1.00000	0.0000	0.0000	4.70	10.70
112.500	288.10	1.00000	0.0000	0.0000	4.70	10.63
107.500	293.10	1.00000	0.0000	0.0000	4.70	10.57
102.500	298.10	1.00000	0.0000	0.0000	4.70	10.50
97.500	303.10	1.00000	0.0000	0.0000	4.70	10.43
92.500	308.10	1.00000	0.0000	0.0000	4.70	10.37
87.500	313.10	1.00000	0.0000	0.0000	4.70	10.30
82.500	318.10	1.00000	0.0000	0.0000	4.70	10.23
77.500	323.10	1.00000	0.0000	0.0000	4.70	10.17
72.500	328.10	1.00000	0.0000	0.0000	4.70	10.10
67.500	333.10	1.00000	0.0000	0.0000	4.70	9.98
62.500	338.10	1.00000	0.0000	0.0000	4.70	9.85
57.500	343.10	1.00000	0.0000	0.0000	4.70	9.73
52.500	348.10	1.00000	0.0000	0.0000	4.70	9.61
47.500	353.10	1.00000	0.0000	0.0000	4.70	9.48
42.500	358.10	1.00000	0.0000	0.0000	4.70	9.36
37.500	363.10	1.00000	0.0000	0.0000	4.70	9.26
32.500	368.10	1.00000	0.0000	0.0000	4.70	9.19
27.500	373.10	1.00000	0.0000	0.0000	4.70	9.11
22.500	378.10	1.00000	0.0000	0.0000	4.70	9.04
17.500	383.10	1.00000	0.0000	0.0000	4.70	9.00
12.500	388.10	1.00000	0.0000	0.0000	4.70	9.00
7.500	393.10	1.00000	0.0000	0.0000	4.70	9.00
2.500	398.10	1.00000	0.0000	0.0000	4.70	9.00

[illegible]

145.60	255.00	+	*	D
140.60	260.00	+	*	D
135.60	265.00	+	*	D
130.60	270.00	+	*	D
125.60	275.00	+	*	D
120.60	280.00	+	*	D
115.60	285.00	+	*	D
110.60	290.00	+	*	D
105.60	295.00	+	*	D
100.60	300.00	+	*	D
95.60	305.00	+	*	D
90.60	310.00	+	*	D
85.60	315.00	+	*	D
80.60	320.00	+	*	D
75.60	325.00	+	*	D
70.60	330.00	+	*	D
65.60	335.00	+	*	D
60.60	340.00	+	*	D
55.60	345.00	+	*	D
50.60	350.00	+	*	D
45.60	355.00	+	*	D
40.60	360.00	+	*	D
35.60	365.00	+	*	D
30.60	370.00	+	*	D
25.60	375.00	+	*	D
20.60	380.00	+	*	D
15.60	385.00	+	*	D
10.60	390.00	+	*	D
5.60	395.00	+	*	D
0.60	400.00	+	*	D

I-----I-----I-----I-----I-----I-----I-----I-----I
0.99900 1.00000 1.00100 1.00200 1.00300 1.00400 1.00500 1.00600 1.00700 1.00800
1.00900

DENSITY G/CC

COUGAR LAKE MAY 29, 1996 SELECT

INPUT/OUTPUT USING RUSH CREEK AS SUBMERGED WEIR

UNITS ARE IN FEET

WEIR CREST ELEVATION 155.000

WEIR LENGTH 100.000

DISCHARGE, VOLUME FLOW PER SEC. 31.0000

TOTAL DISCHARGE, VOLUME PER SEC 31.0000

LOWER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM

151.670 ELEVATION 151.670

LOWER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM

151.670 ELEVATION 151.670

UPPER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM

400.600 ELEVATION 400.600

UPPER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM

400.600 ELEVATION 400.600

OUTFLOW DENSITY 0.99989 G/CC

OUTFLOW TEMPERATURE 7.31

OUTFLOW CONCENTRATION OF TOTAL ORG CARBON 2.35

Elevation	Depth	Density	Norm. Vel.	Flow	Temperature	Total Org. C
400.300	0.30	0.99917	0.0000	0.0000	14.75	5.76
397.500	3.10	0.99923	0.1768	0.1160	14.33	5.37
392.500	8.10	0.99932	0.3943	0.2588	13.64	4.69
387.500	13.10	0.99939	0.5331	0.3498	13.11	4.00
382.500	18.10	0.99957	0.7796	0.5116	11.59	3.32
377.500	23.10	0.99966	0.8716	0.5720	10.69	2.63
372.500	28.10	0.99971	0.9095	0.5968	10.19	1.94
367.500	33.10	0.99974	0.9291	0.6097	9.89	1.30
362.500	38.10	0.99976	0.9422	0.6182	9.66	1.27
357.500	43.10	0.99978	0.9551	0.6267	9.38	1.24
352.500	48.10	0.99980	0.9635	0.6322	9.17	1.21
347.500	53.10	0.99980	0.9673	0.6347	9.09	1.18
342.500	58.10	0.99981	0.9707	0.6370	9.02	1.15
337.500	63.10	0.99982	0.9764	0.6407	8.82	1.12
332.500	68.10	0.99983	0.9804	0.6433	8.66	1.40
327.500	73.10	0.99984	0.9829	0.6449	8.57	1.99
322.500	78.10	0.99985	0.9859	0.6469	8.42	2.58
317.500	83.10	0.99986	0.9885	0.6486	8.27	3.17
312.500	88.10	0.99987	0.9903	0.6498	8.16	3.77
307.500	93.10	0.99987	0.9915	0.6506	8.08	4.36
302.500	98.10	0.99988	0.9926	0.6514	8.01	4.95
297.500	103.10	0.99988	0.9932	0.6517	8.00	4.50
292.500	108.10	0.99988	0.9939	0.6522	7.95	3.95
287.500	113.10	0.99988	0.9948	0.6528	7.88	3.40
282.500	118.10	0.99989	0.9955	0.6533	7.80	2.85
277.500	123.10	0.99989	0.9962	0.6537	7.72	2.30
272.500	128.10	0.99989	0.9966	0.6540	7.70	1.75
267.500	133.10	0.99990	0.9971	0.6543	7.64	1.38

262.500	138.10	0.99991	0.9978	0.6547	7.48	1.34
257.500	143.10	0.99992	0.9986	0.6553	7.18	1.29
252.500	148.10	0.99993	0.9991	0.6556	6.93	1.25
247.500	153.10	0.99994	0.9994	0.6558	6.77	1.20
242.500	158.10	0.99994	0.9995	0.6559	6.67	1.15
237.500	163.10	0.99995	0.9997	0.6560	6.45	1.11
232.500	168.10	0.99996	0.9998	0.6561	6.22	1.44
227.500	173.10	0.99997	0.9999	0.6561	5.91	1.87
222.500	178.10	0.99998	1.0000	0.6562	5.56	2.30
217.500	183.10	0.99999	1.0000	0.6562	5.33	2.72
212.500	188.10	0.99999	1.0000	0.6562	5.23	3.15
207.500	193.10	0.99999	1.0000	0.6562	5.16	3.58
202.500	198.10	0.99999	1.0000	0.6562	5.08	3.82
197.500	203.10	0.99999	1.0000	0.6562	5.00	3.47
192.500	208.10	0.99999	1.0000	0.6562	4.93	3.11
187.500	213.10	0.99999	1.0000	0.6562	4.90	2.76
182.500	218.10	0.99999	1.0000	0.6562	4.90	2.41
177.500	223.10	0.99999	1.0000	0.6562	4.90	2.06
172.500	228.10	0.99999	1.0000	0.6562	4.82	1.71
167.500	233.10	0.99999	1.0000	0.6562	4.80	1.61
162.500	238.10	0.99999	1.0000	0.6562	4.80	1.63
157.500	243.10	0.99999	1.0000	0.6562	4.80	1.64
152.500	248.10	0.99999	1.0000	0.6562	4.80	1.66
147.500	253.10	0.99999	0.0000	0.0000	4.79	1.67
142.500	258.10	1.00000	0.0000	0.0000	4.77	1.69
137.500	263.10	1.00000	0.0000	0.0000	4.75	1.77
132.500	268.10	1.00000	0.0000	0.0000	4.73	2.31
127.500	273.10	1.00000	0.0000	0.0000	4.71	2.86
122.500	278.10	1.00000	0.0000	0.0000	4.70	3.41
117.500	283.10	1.00000	0.0000	0.0000	4.70	3.96
112.500	288.10	1.00000	0.0000	0.0000	4.70	4.51
107.500	293.10	1.00000	0.0000	0.0000	4.70	5.06
102.500	298.10	1.00000	0.0000	0.0000	4.70	4.98
97.500	303.10	1.00000	0.0000	0.0000	4.70	4.40
92.500	308.10	1.00000	0.0000	0.0000	4.70	3.82
87.500	313.10	1.00000	0.0000	0.0000	4.70	3.24
82.500	318.10	1.00000	0.0000	0.0000	4.70	2.66
77.500	323.10	1.00000	0.0000	0.0000	4.70	2.08
72.500	328.10	1.00000	0.0000	0.0000	4.70	1.50
67.500	333.10	1.00000	0.0000	0.0000	4.70	1.52
62.500	338.10	1.00000	0.0000	0.0000	4.70	1.53
57.500	343.10	1.00000	0.0000	0.0000	4.70	1.55
52.500	348.10	1.00000	0.0000	0.0000	4.70	1.56
47.500	353.10	1.00000	0.0000	0.0000	4.70	1.58
42.500	358.10	1.00000	0.0000	0.0000	4.70	1.59
37.500	363.10	1.00000	0.0000	0.0000	4.70	1.60
32.500	368.10	1.00000	0.0000	0.0000	4.70	1.60
27.500	373.10	1.00000	0.0000	0.0000	4.70	1.60
22.500	378.10	1.00000	0.0000	0.0000	4.70	1.60
17.500	383.10	1.00000	0.0000	0.0000	4.70	1.60
12.500	388.10	1.00000	0.0000	0.0000	4.70	1.60
7.500	393.10	1.00000	0.0000	0.0000	4.70	1.60
2.500	398.10	1.00000	0.0000	0.0000	4.70	1.60

COUGAR LAKE MAY 29, 1996 SELECT

INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR

UNITS ARE IN FEET

WEIR CREST ELEVATION 155.000
WEIR LENGTH 100.000
DISCHARGE, VOLUME FLOW PER SEC. 31.0000

TOTAL DISCHARGE, VOLUME PER SEC 31.0000

LOWER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM 151.670
ELEVATION 151.670

LOWER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM 151.670
ELEVATION 151.670

UPPER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM 400.600
ELEVATION 400.600

UPPER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM
400.600 ELEVATION 400.600

OUTFLOW DENSITY 0.99989 G/CC

OUTFLOW TEMPERATURE 7.31

OUTFLOW CONCENTRATION OF DISS ORG CARBON 1.75

1

Elevation	Depth	Density	Norm. Vel.	Flow	Temperature	Diss. Org. C
400.300	0.30	0.99917	0.0000	0.0000	14.75	2.19
397.500	3.10	0.99923	0.1768	0.1160	14.33	2.11
392.500	8.10	0.99932	0.3943	0.2588	13.64	1.95
387.500	13.10	0.99939	0.5331	0.3498	13.11	1.80
382.500	18.10	0.99957	0.7796	0.5116	11.59	1.65
377.500	23.10	0.99966	0.8716	0.5720	10.69	1.50
372.500	28.10	0.99971	0.9095	0.5968	10.19	1.34
367.500	33.10	0.99974	0.9291	0.6097	9.89	1.20
362.500	38.10	0.99976	0.9422	0.6182	9.66	1.18
357.500	43.10	0.99978	0.9551	0.6267	9.38	1.17
352.500	48.10	0.99980	0.9635	0.6322	9.17	1.15
347.500	53.10	0.99980	0.9673	0.6347	9.09	1.14
342.500	58.10	0.99981	0.9707	0.6370	9.02	1.12
337.500	63.10	0.99982	0.9764	0.6407	8.82	1.11
332.500	68.10	0.99983	0.9804	0.6433	8.66	1.28
327.500	73.10	0.99984	0.9829	0.6449	8.57	1.65
322.500	78.10	0.99985	0.9859	0.6469	8.42	2.01
317.500	83.10	0.99986	0.9885	0.6486	8.27	2.38
312.500	88.10	0.99987	0.9903	0.6498	8.16	2.74
307.500	93.10	0.99987	0.9915	0.6506	8.08	3.11
302.500	98.10	0.99988	0.9926	0.6514	8.01	3.47
297.500	103.10	0.99988	0.9932	0.6517	8.00	3.19
292.500	108.10	0.99988	0.9939	0.6522	7.95	2.86
287.500	113.10	0.99988	0.9948	0.6528	7.88	2.52
282.500	118.10	0.99989	0.9955	0.6533	7.80	2.19
277.500	123.10	0.99989	0.9962	0.6537	7.72	1.85
272.500	128.10	0.99989	0.9966	0.6540	7.70	1.51
267.500	133.10	0.99990	0.9971	0.6543	7.64	1.30

262.500	138.10	0.99991	0.9978	0.6547	7.48	1.30
257.500	143.10	0.99992	0.9986	0.6553	7.18	1.30
252.500	148.10	0.99993	0.9991	0.6556	6.93	1.30
247.500	153.10	0.99994	0.9994	0.6558	6.77	1.30
242.500	158.10	0.99994	0.9995	0.6559	6.67	1.30
237.500	163.10	0.99995	0.9997	0.6560	6.45	1.30
232.500	168.10	0.99996	0.9998	0.6561	6.22	1.43
227.500	173.10	0.99997	0.9999	0.6561	5.91	1.60
222.500	178.10	0.99998	1.0000	0.6562	5.56	1.77
217.500	183.10	0.99999	1.0000	0.6562	5.33	1.94
212.500	188.10	0.99999	1.0000	0.6562	5.23	2.10
207.500	193.10	0.99999	1.0000	0.6562	5.16	2.27
202.500	198.10	0.99999	1.0000	0.6562	5.08	2.37
197.500	203.10	0.99999	1.0000	0.6562	5.00	2.23
192.500	208.10	0.99999	1.0000	0.6562	4.93	2.09
187.500	213.10	0.99999	1.0000	0.6562	4.90	1.96
182.500	218.10	0.99999	1.0000	0.6562	4.90	1.82
177.500	223.10	0.99999	1.0000	0.6562	4.90	1.68
172.500	228.10	0.99999	1.0000	0.6562	4.82	1.54
167.500	233.10	0.99999	1.0000	0.6562	4.80	1.48
162.500	238.10	0.99999	1.0000	0.6562	4.80	1.45
157.500	243.10	0.99999	1.0000	0.6562	4.80	1.42
152.500	248.10	0.99999	1.0000	0.6562	4.80	1.39
147.500	253.10	0.99999	0.0000	0.0000	4.79	1.36
142.500	258.10	1.00000	0.0000	0.0000	4.77	1.33
137.500	263.10	1.00000	0.0000	0.0000	4.75	1.33
132.500	268.10	1.00000	0.0000	0.0000	4.73	1.56
127.500	273.10	1.00000	0.0000	0.0000	4.71	1.78
122.500	278.10	1.00000	0.0000	0.0000	4.70	2.01
117.500	283.10	1.00000	0.0000	0.0000	4.70	2.24
112.500	288.10	1.00000	0.0000	0.0000	4.70	2.47
107.500	293.10	1.00000	0.0000	0.0000	4.70	2.70
102.500	298.10	1.00000	0.0000	0.0000	4.70	2.68
97.500	303.10	1.00000	0.0000	0.0000	4.70	2.47
92.500	308.10	1.00000	0.0000	0.0000	4.70	2.25
87.500	313.10	1.00000	0.0000	0.0000	4.70	2.04
82.500	318.10	1.00000	0.0000	0.0000	4.70	1.83
77.500	323.10	1.00000	0.0000	0.0000	4.70	1.61
72.500	328.10	1.00000	0.0000	0.0000	4.70	1.40
67.500	333.10	1.00000	0.0000	0.0000	4.70	1.42
62.500	338.10	1.00000	0.0000	0.0000	4.70	1.43
57.500	343.10	1.00000	0.0000	0.0000	4.70	1.45
52.500	348.10	1.00000	0.0000	0.0000	4.70	1.46
47.500	353.10	1.00000	0.0000	0.0000	4.70	1.48
42.500	358.10	1.00000	0.0000	0.0000	4.70	1.49
37.500	363.10	1.00000	0.0000	0.0000	4.70	1.50
32.500	368.10	1.00000	0.0000	0.0000	4.70	1.50
27.500	373.10	1.00000	0.0000	0.0000	4.70	1.50
22.500	378.10	1.00000	0.0000	0.0000	4.70	1.50
17.500	383.10	1.00000	0.0000	0.0000	4.70	1.50
12.500	388.10	1.00000	0.0000	0.0000	4.70	1.50
7.500	393.10	1.00000	0.0000	0.0000	4.70	1.50
2.500	398.10	1.00000	0.0000	0.0000	4.70	1.50

```

1000 ***COUGAR LAKE JULY 10, 1996 SELECT
1010 ***DATA SETS 01
1020 ***PRINT INPUT
1030 ***INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR
1040 ***ENGLISH
1050 ***TABLE 01
1060 ***THICKNESS 5.0
1070 ***INTERVAL 01
1080 ***SURFACE 400.6
1090 ***BOTTOM 0.0
1100 ***WEIR
1110 ***SUBMERGED
1120 ***LENGTH 100.
1130 ***HEIGHT 155.0
1140 ***FLOW 14.1
1150 ***NUMBER OF TEMP 41
1160 ***TEMPERATURE DEGREES CENTIGRADE
1170 ***HEIGHT TEMP
1180 *** 400.6 21.6
1190 *** 394.0 21.3
1200 *** 387.4 21.1
1210 *** 380.9 17.7
1220 *** 374.3 15.4
1230 *** 367.8 13.4
1240 *** 361.2 12.1
1250 *** 354.6 11.2
1260 *** 348.1 10.7
1270 *** 341.5 10.4
1280 *** 335.0 9.9
1290 *** 328.4 9.7
1300 *** 321.8 9.4
1310 *** 315.3 9.3
1320 *** 308.7 9.1
1330 *** 302.1 9.0
1340 *** 295.6 8.9
1350 *** 289.0 8.9
1360 *** 282.5 8.7
1370 *** 275.9 8.6
1380 *** 269.3 8.6
1390 *** 262.8 8.5
1400 *** 256.2 8.4
1410 *** 249.7 8.3
1420 *** 243.1 8.2
1430 *** 236.5 8.2
1440 *** 230.0 8.1
1450 *** 216.8 7.7
1460 *** 210.3 6.7
1470 *** 203.7 5.8
1480 *** 184.0 5.3
1490 *** 170.9 5.2
1500 *** 153.5 5.1
1510 *** 137.1 5.0
1520 *** 120.7 4.9
1530 *** 104.3 4.9

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1540	***	87.9	4.8
1550	***	71.5	4.8
1560	***	55.1	4.8
1570	***	38.7	4.8
1580	***	5.9	4.8
1590	***	QUALITIES 1	
1600	***	NUMBER OF DISSOLVED OXYGEN	41
1610	***	HEIGHT	DISSOLVED OXYGEN
1620	***	400.6	9.0
1630	***	394.0	9.0
1640	***	387.4	9.1
1650	***	380.9	12.0
1660	***	374.3	13.5
1670	***	367.8	12.8
1680	***	361.2	10.8
1690	***	354.6	9.8
1700	***	348.1	9.5
1710	***	341.5	9.2
1720	***	335.0	9.2
1730	***	328.4	9.5
1740	***	321.8	9.7
1750	***	315.3	9.9
1760	***	308.7	10.0
1770	***	302.1	10.2
1780	***	295.6	10.2
1790	***	289.0	10.1
1800	***	282.5	10.3
1810	***	275.9	10.3
1820	***	269.3	10.4
1830	***	262.8	10.2
1840	***	256.2	10.4
1850	***	249.7	10.3
1860	***	243.1	10.5
1870	***	236.5	10.5
1880	***	230.0	10.5
1890	***	216.8	10.4
1900	***	210.3	9.9
1910	***	203.7	10.1
1920	***	184.0	10.0
1930	***	170.9	10.1
1940	***	153.5	10.2
1950	***	137.1	10.1
1960	***	120.7	10.0
1970	***	104.3	10.1
1980	***	87.9	9.9
1990	***	71.5	9.5
2000	***	55.1	9.0
2010	***	38.7	8.7
2020	***	5.9	8.1
2030	***	STOP	

COUGAR LAKE JULY 10, 1996 SELECT

INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR
UNITS ARE IN FEET

WEIR CREST ELEVATION 155.000

WEIR LENGTH 100.000

DISCHARGE, VOLUME FLOW PER SEC. 14.0000

TOTAL DISCHARGE, VOLUME PER SEC 14.0000

LOWER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM 154.697
ELEVATION 154.697

LOWER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM
154.697 ELEVATION 154.697

UPPER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM 400.600
ELEVATION 400.600

UPPER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM
400.600 ELEVATION 400.600

OUTFLOW DENSITY 0.99978 G/CC

OUTFLOW TEMPERATURE 8.67

OUTFLOW CONCENTRATION OF DISSOLVED OXYGEN 10.27

1

ELEVATION	DEPTH	DENSITY	NORM. VEL.	FLOW	TEMPERATURE
DISSOLVED OX					
400.300	0.30	0.99789	0.0000	21.59	9.00
397.500	3.10	0.99792	0.0653	21.46	9.00
392.500	8.10	0.99797	0.1417	21.25	9.02
387.500	13.10	0.99800	0.2038	21.10	9.10
382.500	18.10	0.99852	0.5862	18.54	11.29
377.500	23.10	0.99889	0.7758	16.52	12.77
372.500	28.10	0.99915	0.8762	14.85	13.31
367.500	33.10	0.99936	0.9336	13.34	12.71
362.500	38.10	0.99948	0.9590	12.36	11.19
357.500	43.10	0.99957	0.9732	11.60	10.24
352.500	48.10	0.99963	0.9811	11.04	9.70
347.500	53.10	0.99967	0.9855	10.67	9.47
342.500	58.10	0.99969	0.9880	10.45	9.25
337.500	63.10	0.99972	0.9909	10.09	9.20
332.500	68.10	0.99974	0.9928	9.82	9.31
327.500	73.10	0.99976	0.9940	9.66	9.53
322.500	78.10	0.99978	0.9952	9.43	9.68
317.500	83.10	0.99978	0.9958	9.33	9.83
312.500	88.10	0.99979	0.9964	9.22	9.94
307.500	93.10	0.99980	0.9969	9.08	10.04
302.500	98.10	0.99981	0.9973	9.01	10.19
297.500	103.10	0.99981	0.9976	8.93	10.20
292.500	108.10	0.99982	0.9979	8.90	10.15
287.500	113.10	0.99982	0.9981	8.85	10.15
282.500	118.10	0.99983	0.9984	8.70	10.30
277.500	123.10	0.99984	0.9987	8.62	10.30
272.500	128.10	0.99984	0.9988	8.60	10.35
267.500	133.10	0.99984	0.9989	8.57	10.34

262.500	138.10	0.99984	0.9991	0.3014	8.50	10.21
257.500	143.10	0.99985	0.9992	0.3014	8.42	10.36
252.500	148.10	0.99985	0.9993	0.3014	8.34	10.34
247.500	153.10	0.99986	0.9994	0.3015	8.27	10.37
242.500	158.10	0.99986	0.9995	0.3015	8.20	10.50
237.500	163.10	0.99986	0.9996	0.3015	8.20	10.50
232.500	168.10	0.99987	0.9997	0.3015	8.14	10.50
227.500	173.10	0.99988	0.9997	0.3016	8.02	10.48
222.500	178.10	0.99988	0.9998	0.3016	7.87	10.44
217.500	183.10	0.99989	0.9999	0.3016	7.72	10.41
212.500	188.10	0.99993	0.9999	0.3016	7.04	10.07
207.500	193.10	0.99996	1.0000	0.3016	6.32	9.98
202.500	198.10	0.99998	1.0000	0.3016	5.77	10.09
197.500	203.10	0.99998	1.0000	0.3016	5.64	10.07
192.500	208.10	0.99998	1.0000	0.3016	5.52	10.04
187.500	213.10	0.99998	1.0000	0.3016	5.39	10.02
182.500	218.10	0.99999	1.0000	0.3016	5.29	10.01
177.500	223.10	0.99999	1.0000	0.3016	5.25	10.05
172.500	228.10	0.99999	1.0000	0.3016	5.21	10.09
167.500	233.10	0.99999	1.0000	0.3016	5.18	10.12
162.500	238.10	0.99999	1.0000	0.3016	5.15	10.15
157.500	243.10	0.99999	1.0000	0.3016	5.12	10.18
152.500	248.10	0.99999	1.0000	0.3016	5.09	10.19
147.500	253.10	0.99999	0.0000	0.0000	5.06	10.16
142.500	258.10	0.99999	0.0000	0.0000	5.03	10.13
137.500	263.10	0.99999	0.0000	0.0000	5.00	10.10
132.500	268.10	0.99999	0.0000	0.0000	4.97	10.07
127.500	273.10	0.99999	0.0000	0.0000	4.94	10.04
122.500	278.10	0.99999	0.0000	0.0000	4.91	10.01
117.500	283.10	0.99999	0.0000	0.0000	4.90	10.02
112.500	288.10	0.99999	0.0000	0.0000	4.90	10.05
107.500	293.10	0.99999	0.0000	0.0000	4.90	10.08
102.500	298.10	0.99999	0.0000	0.0000	4.89	10.08
97.500	303.10	0.99999	0.0000	0.0000	4.86	10.02
92.500	308.10	0.99999	0.0000	0.0000	4.83	9.96
87.500	313.10	0.99999	0.0000	0.0000	4.80	9.89
82.500	318.10	0.99999	0.0000	0.0000	4.80	9.77
77.500	323.10	0.99999	0.0000	0.0000	4.80	9.65
72.500	328.10	0.99999	0.0000	0.0000	4.80	9.52
67.500	333.10	0.99999	0.0000	0.0000	4.80	9.38
62.500	338.10	0.99999	0.0000	0.0000	4.80	9.23
57.500	343.10	0.99999	0.0000	0.0000	4.80	9.07
52.500	348.10	0.99999	0.0000	0.0000	4.80	8.95
47.500	353.10	0.99999	0.0000	0.0000	4.80	8.86
42.500	358.10	0.99999	0.0000	0.0000	4.80	8.77
37.500	363.10	0.99999	0.0000	0.0000	4.80	8.68
32.500	368.10	0.99999	0.0000	0.0000	4.80	8.59
27.500	373.10	0.99999	0.0000	0.0000	4.80	8.50
22.500	378.10	0.99999	0.0000	0.0000	4.80	8.40
17.500	383.10	0.99999	0.0000	0.0000	4.80	8.31
12.500	388.10	0.99999	0.0000	0.0000	4.80	8.22
7.500	393.10	0.99999	0.0000	0.0000	4.80	8.13
2.500	398.10	0.99999	0.0000	0.0000	4.80	8.10

	VELOCITY (TIMES 1000)										
	0	200	400	600	800	1000	1200	1400	1600	1800	2000
	I-----I	I-----I	I-----I	I-----I	I-----I	I-----I	I-----I	I-----I	I-----I	I-----I	I-----I
400.60	0.00 +*		D								
395.60	5.00 +	V	D								
390.60	10.00 +		V D								
385.60	15.00 +		D V								
380.60	20.00 +			D		V					
375.60	25.00 +				D		V				
370.60	30.00 +				D			V			
365.60	35.00 +				D			V			
360.60	40.00 +				D			V			
355.60	45.00 +				D			V			
350.60	50.00 +				D			V			
345.60	55.00 +				D			V			
340.60	60.00 +				D			V			
335.60	65.00 +				D			V			
330.60	70.00 +				D			V			
325.60	75.00 +				D			V			
320.60	80.00 +				D			V			
315.60	85.00 +				D			V			
310.60	90.00 +				D			V			
305.60	95.00 +				D			V			
300.60	100.00 +				D			V			
295.60	105.00 +				D			V			
290.60	110.00 +				D			V			
285.60	115.00 +				D			V			
280.60	120.00 +				D			V			
275.60	125.00 +				D			V			
270.60	130.00 +				D			V			
265.60	135.00 +				D			V			
260.60	140.00 +				D			V			
255.60	145.00 +				D			V			
250.60	150.00 +				D			V			
245.60	155.00 +				D			V			
240.60	160.00 +				D			V			
235.60	165.00 +				D			V			
230.60	170.00 +				D			V			
225.60	175.00 +				D			V			
220.60	180.00 +				D			V			
215.60	185.00 +				D			V			
210.60	190.00 +				D			V			
205.60	195.00 +				D			V			
200.60	200.00 +				D			V			
195.60	205.00 +				D			V			
190.60	210.00 +				D			V			
185.60	215.00 +				D			V			
180.60	220.00 +				D			V			
175.60	225.00 +				D			V			
170.60	230.00 +				D			V			
165.60	235.00 +				D			V			

TEMPERATURE °C	DENSITY G/CC	REFRACTIVE INDEX	DISPERSION	BIREFRINGENCE
160.60	240.00	+	D	V
155.60	245.00	+	D	V
150.60	250.00	+	D	V
145.60	255.00	+	D	
140.60	260.00	+	D	
135.60	265.00	+	D	
130.60	270.00	+	D	
125.60	275.00	+	D	
120.60	280.00	+	D	
115.60	285.00	+	D	
110.60	290.00	+	D	
105.60	295.00	+	D	
100.60	300.00	+	D	
95.60	305.00	+	D	
90.60	310.00	+	D	
85.60	315.00	+	D	
80.60	320.00	+	D	
75.60	325.00	+	D	
70.60	330.00	+	D	
65.60	335.00	+	D	
60.60	340.00	+	D	
55.60	345.00	+	D	
50.60	350.00	+	D	
45.60	355.00	+	D	
40.60	360.00	+	D	
35.60	365.00	+	D	
30.60	370.00	+	D	
25.60	375.00	+	D	
20.60	380.00	+	D	
15.60	385.00	+	D	
10.60	390.00	+	D	
5.60	395.00	+	D	
0.60	400.00	+	D	


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1000 ***COUGAR LAKE JULY 23, 1996 SELECT
1010 ***DATA SETS 01
1020 ***PRINT INPUT
1030 ***INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR
1040 ***ENGLISH
1050 ***TABLE 01
1060 ***THICKNESS 5.0
1070 ***INTERVAL 01
1080 ***SURFACE 397.8
1090 ***BOTTOM 0.0
1100 ***WEIR
1110 ***SUBMERGED
1120 ***LENGTH 100.
1130 ***HEIGHT 155.0
1140 ***FLOW 14.1
1150 ***NUMBER OF TEMP 40
1160 ***TEMPERATURE DEGREES CENTIGRADE
1170 ***HEIGHT TEMP
1180 *** 397.8 22.2
1190 *** 391.2 22.1
1200 *** 384.4 22.0
1210 *** 378.1 17.9
1220 *** 371.6 16.1
1230 *** 365.0 14.4
1240 *** 358.5 13.5
1250 *** 351.9 12.4
1260 *** 345.3 11.6
1270 *** 338.8 10.9
1280 *** 332.2 10.5
1290 *** 325.7 10.2
1300 *** 319.1 9.9
1310 *** 312.5 9.6
1320 *** 306.0 9.4
1330 *** 299.4 9.2
1340 *** 292.8 9.1
1350 *** 286.3 8.9
1360 *** 297.7 8.8
1370 *** 273.2 8.6
1380 *** 266.6 8.6
1390 *** 260.0 8.5
1400 *** 253.5 8.4
1410 *** 246.9 8.3
1420 *** 240.3 8.3
1430 *** 233.8 8.2
1440 *** 217.4 7.0
1450 *** 201.0 5.6
1460 *** 184.6 5.4
1470 *** 168.2 5.2
1480 *** 151.8 5.1
1490 *** 135.4 5.0
1500 *** 119.0 5.0
1510 *** 102.6 4.9
1520 *** 86.2 4.8
1530 *** 69.7 4.8

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1540	***	53.3	4.8
1550	***	36.9	4.8
1560	***	20.5	4.8
1570	***	7.4	4.8
1580	***	QUALITIES	1
1590	***	NUMBER OF DISSOLVED OXYGEN	40
1600	***	HEIGHT	DISSOLVED OXYGEN
1610	***	397.8	8.2
1620	***	391.2	8.2
1630	***	384.4	7.9
1640	***	378.1	13.0
1650	***	371.6	14.9
1660	***	365.0	13.8
1670	***	358.5	10.9
1680	***	351.9	9.7
1690	***	345.3	8.9
1700	***	338.8	8.3
1710	***	332.2	8.1
1720	***	325.7	8.1
1730	***	319.1	8.1
1740	***	312.5	8.6
1750	***	306.0	8.9
1760	***	299.4	9.0
1770	***	292.8	9.1
1780	***	286.3	9.1
1790	***	297.7	9.2
1800	***	273.2	9.6
1810	***	266.6	9.4
1820	***	260.0	9.6
1830	***	253.5	9.5
1840	***	246.9	9.4
1850	***	240.3	9.5
1860	***	233.8	9.7
1870	***	217.4	9.4
1880	***	201.0	9.1
1890	***	184.6	9.2
1900	***	168.2	9.4
1910	***	151.8	9.5
1920	***	135.4	9.5
1930	***	119.0	9.5
1940	***	102.6	9.4
1950	***	86.2	9.3
1960	***	69.7	9.2
1970	***	53.3	8.6
1980	***	36.9	7.3
1990	***	20.5	2.0
2000	***	7.4	1.1
2010	***	STOP	

COUGAR LAKE JULY 23, 1996 SELECT

INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR
UNITS ARE IN FEET

WEIR CREST ELEVATION 155.000

WEIR LENGTH 100.000

DISCHARGE, VOLUME FLOW PER SEC. 14.0000

TOTAL DISCHARGE, VOLUME PER SEC 14.0000

LOWER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM 154.697
ELEVATION 154.697

LOWER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM
154.697 ELEVATION 154.697

UPPER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM 397.800
ELEVATION 397.800

UPPER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM
397.800 ELEVATION 397.800

OUTFLOW DENSITY 0.99976 G/CC

OUTFLOW TEMPERATURE 8.81

OUTFLOW CONCENTRATION OF DISSOLVED OXYGEN 9.54

1

Elevation	Depth	Density	Norm. Vel.	Flow	Temperature	Diss. Oxygen
396.400	1.40	0.99776	0.0000	0.0000	22.18	8.20
392.500	5.30	0.99777	0.0520	0.0159	22.12	8.20
387.500	10.30	0.99779	0.1048	0.0322	22.05	8.04
382.500	15.30	0.99807	0.3490	0.1071	20.76	9.44
377.500	20.30	0.99867	0.7062	0.2167	17.73	13.18
372.500	25.30	0.99891	0.8126	0.2493	16.35	14.64
367.500	30.30	0.99912	0.8833	0.2711	15.04	14.22
362.500	35.30	0.99927	0.9225	0.2831	14.05	12.68
357.500	40.30	0.99936	0.9447	0.2899	13.33	10.72
352.500	45.30	0.99947	0.9634	0.2956	12.50	9.81
347.500	50.30	0.99954	0.9744	0.2990	11.87	9.17
342.500	55.30	0.99960	0.9819	0.3013	11.30	8.64
337.500	60.30	0.99965	0.9869	0.3028	10.82	8.26
332.500	65.30	0.99968	0.9896	0.3037	10.52	8.11
327.500	70.30	0.99970	0.9915	0.3043	10.28	8.10
322.500	75.30	0.99972	0.9931	0.3047	10.05	8.10
317.500	80.30	0.99974	0.9944	0.3051	9.83	8.22
312.500	85.30	0.99976	0.9956	0.3055	9.60	8.60
307.500	90.30	0.99977	0.9963	0.3057	9.45	8.83
302.500	95.30	0.99979	0.9969	0.3059	9.29	8.95
297.500	100.30	0.99982	0.9981	0.3063	8.80	9.20
292.500	105.30	0.99983	0.9983	0.3063	8.76	9.28
287.500	110.30	0.99983	0.9984	0.3064	8.72	9.37
282.500	115.30	0.99983	0.9986	0.3064	8.68	9.45
277.500	120.30	0.99984	0.9987	0.3065	8.64	9.53
272.500	125.30	0.99984	0.9989	0.3065	8.60	9.58
267.500	130.30	0.99984	0.9990	0.3065	8.60	9.43
262.500	135.30	0.99984	0.9991	0.3066	8.54	9.52
257.500	140.30	0.99985	0.9992	0.3066	8.46	9.56

252.500	145.30	0.99985	0.9994	0.3067	8.38	9.48
247.500	150.30	0.99986	0.9995	0.3067	8.31	9.41
242.500	155.30	0.99986	0.9995	0.3067	8.30	9.47
237.500	160.30	0.99986	0.9996	0.3067	8.26	9.59
232.500	165.30	0.99987	0.9997	0.3068	8.10	9.68
227.500	170.30	0.99989	0.9998	0.3068	7.74	9.58
222.500	175.30	0.99991	0.9999	0.3068	7.37	9.49
217.500	180.30	0.99993	0.9999	0.3068	7.01	9.40
212.500	185.30	0.99995	1.0000	0.3068	6.58	9.31
207.500	190.30	0.99996	1.0000	0.3068	6.15	9.22
202.500	195.30	0.99998	1.0000	0.3069	5.73	9.13
197.500	200.30	0.99998	1.0000	0.3069	5.56	9.12
192.500	205.30	0.99998	1.0000	0.3069	5.50	9.15
187.500	210.30	0.99998	1.0000	0.3069	5.44	9.18
182.500	215.30	0.99998	1.0000	0.3069	5.37	9.23
177.500	220.30	0.99999	1.0000	0.3069	5.31	9.29
172.500	225.30	0.99999	1.0000	0.3069	5.25	9.35
167.500	230.30	0.99999	1.0000	0.3069	5.20	9.40
162.500	235.30	0.99999	1.0000	0.3069	5.17	9.43
157.500	240.30	0.99999	1.0000	0.3069	5.13	9.47
152.500	245.30	0.99999	1.0000	0.3069	5.10	9.50
147.500	250.30	0.99999	0.0000	0.0000	5.07	9.50
142.500	255.30	0.99999	0.0000	0.0000	5.04	9.50
137.500	260.30	0.99999	0.0000	0.0000	5.01	9.50
132.500	265.30	0.99999	0.0000	0.0000	5.00	9.50
127.500	270.30	0.99999	0.0000	0.0000	5.00	9.50
122.500	275.30	0.99999	0.0000	0.0000	5.00	9.50
117.500	280.30	0.99999	0.0000	0.0000	4.99	9.49
112.500	285.30	0.99999	0.0000	0.0000	4.96	9.46
107.500	290.30	0.99999	0.0000	0.0000	4.93	9.43
102.500	295.30	0.99999	0.0000	0.0000	4.90	9.40
97.500	300.30	0.99999	0.0000	0.0000	4.87	9.37
92.500	305.30	0.99999	0.0000	0.0000	4.84	9.34
87.500	310.30	0.99999	0.0000	0.0000	4.81	9.31
82.500	315.30	0.99999	0.0000	0.0000	4.80	9.28
77.500	320.30	0.99999	0.0000	0.0000	4.80	9.25
72.500	325.30	0.99999	0.0000	0.0000	4.80	9.22
67.500	330.30	0.99999	0.0000	0.0000	4.80	9.12
62.500	335.30	0.99999	0.0000	0.0000	4.80	8.94
57.500	340.30	0.99999	0.0000	0.0000	4.80	8.75
52.500	345.30	0.99999	0.0000	0.0000	4.80	8.54
47.500	350.30	0.99999	0.0000	0.0000	4.80	8.14
42.500	355.30	0.99999	0.0000	0.0000	4.80	7.74
37.500	360.30	0.99999	0.0000	0.0000	4.80	7.35
32.500	365.30	0.99999	0.0000	0.0000	4.80	5.88
27.500	370.30	0.99999	0.0000	0.0000	4.80	4.26
22.500	375.30	0.99999	0.0000	0.0000	4.80	2.65
17.500	380.30	0.99999	0.0000	0.0000	4.80	1.79
12.500	385.30	0.99999	0.0000	0.0000	4.80	1.45
7.500	390.30	0.99999	0.0000	0.0000	4.80	1.11
2.500	395.30	0.99999	0.0000	0.0000	4.80	1.10

	VELOCITY (TIMES 1000)										
	0	200	400	600	800	1000	1200	1400	1600	1800	2000
	I-----I-----I-----I-----I-----I-----I-----I-----I-----I-----I										
397.80	0.00	+*		D							
392.80	5.00	+	V	D							
387.80	10.00	+		V D							
382.80	15.00	+		D	V						
377.80	20.00	+			D	V					
372.80	25.00	+			D		V				
367.80	30.00	+			D		V				
362.80	35.00	+			D		V				
357.80	40.00	+			D		V				
352.80	45.00	+			D		V				
347.80	50.00	+			D		V				
342.80	55.00	+			D		V				
337.80	60.00	+			D		V				
332.80	65.00	+			D		V				
327.80	70.00	+			D		V				
322.80	75.00	+			D		V				
317.80	80.00	+			D		V				
312.80	85.00	+			D		V				
307.80	90.00	+			D		V				
302.80	95.00	+			D		V				
297.80	100.00	+			D		V				
292.80	105.00	+			D		V				
287.80	110.00	+			D		V				
282.80	115.00	+			D		V				
277.80	120.00	+			D		V				
272.80	125.00	+			D		V				
267.80	130.00	+			D		V				
262.80	135.00	+			D		V				
257.80	140.00	+			D		V				
252.80	145.00	+			D		V				
247.80	150.00	+			D		V				
242.80	155.00	+			D		V				
237.80	160.00	+			D		V				
232.80	165.00	+			D		V				
227.80	170.00	+			D		V				
222.80	175.00	+			D		V				
217.80	180.00	+			D		V				
212.80	185.00	+			D		V				
207.80	190.00	+			D		V				
202.80	195.00	+			D		V				
197.80	200.00	+			D		V				
192.80	205.00	+			D		V				
187.80	210.00	+			D		V				
182.80	215.00	+			D		V				
177.80	220.00	+			D		V				
172.80	225.00	+			D		V				
167.80	230.00	+			D		V				
162.80	235.00	+			D		V				
157.80	240.00	+			D		V				
152.80	245.00	+			D		V				
147.80	250.00	+*			D						

142.80	255.00	+	*	D
137.80	260.00	+	*	D
132.80	265.00	+	*	D
127.80	270.00	+	*	D
122.80	275.00	+	*	D
117.80	280.00	+	*	D
112.80	285.00	+	*	D
107.80	290.00	+	*	D
102.80	295.00	+	*	D
97.80	300.00	+	*	D
92.80	305.00	+	*	D
87.80	310.00	+	*	D
82.80	315.00	+	*	D
77.80	320.00	+	*	D
72.80	325.00	+	*	D
67.80	330.00	+	*	D
62.80	335.00	+	*	D
57.80	340.00	+	*	D
52.80	345.00	+	*	D
47.80	350.00	+	*	D
42.80	355.00	+	*	D
37.80	360.00	+	*	D
32.80	365.00	+	*	D
27.80	370.00	+	*	D
22.80	375.00	+	*	D
17.80	380.00	+	*	D
12.80	385.00	+	*	D
7.80	390.00	+	*	D
2.80	395.00	+	*	D

DENSITY G/CC

COUGAR LAKE JULY 23, 1996 SELECT

INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR

UNITS ARE IN FEET

WEIR CREST ELEVATION 155.000
WEIR LENGTH 100.000
DISCHARGE, VOLUME FLOW PER SEC. 14.0000

TOTAL DISCHARGE, VOLUME PER SEC 14.0000

LOWER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM
154.697 ELEVATION 154.697
LOWER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE
BOTTOM 154.697 ELEVATION 154.697
UPPER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM
397.800 ELEVATION 397.800
UPPER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE
BOTTOM 397.800 ELEVATION 397.800
OUTFLOW DENSITY 0.99976 G/CC
OUTFLOW TEMPERATURE 8.81
OUTFLOW CONCENTRATION OF TOTAL ORGCARBON 1.34

Elevation	Depth	Density	Norm. Vel.	Flow	Temperature	Total Org. C
396.400	1.40	0.99776	0.0000	0.0000	22.18	1.41
392.500	5.30	0.99777	0.0520	0.0159	22.12	1.43
387.500	10.30	0.99779	0.1048	0.0322	22.05	1.46
382.500	15.30	0.99807	0.3490	0.1071	20.76	1.49
377.500	20.30	0.99867	0.7062	0.2167	17.73	1.52
372.500	25.30	0.99891	0.8126	0.2493	16.35	1.55
367.500	30.30	0.99912	0.8833	0.2711	15.04	1.58
362.500	35.30	0.99927	0.9225	0.2831	14.05	1.58
357.500	40.30	0.99936	0.9447	0.2899	13.33	1.53
352.500	45.30	0.99947	0.9634	0.2956	12.50	1.49
347.500	50.30	0.99954	0.9744	0.2990	11.87	1.44
342.500	55.30	0.99960	0.9819	0.3013	11.30	1.39
337.500	60.30	0.99965	0.9869	0.3028	10.82	1.35
332.500	65.30	0.99968	0.9896	0.3037	10.52	1.30
327.500	70.30	0.99970	0.9915	0.3043	10.28	1.30
322.500	75.30	0.99972	0.9931	0.3047	10.05	1.30
317.500	80.30	0.99974	0.9944	0.3051	9.83	1.30
312.500	85.30	0.99976	0.9956	0.3055	9.60	1.30
307.500	90.30	0.99977	0.9963	0.3057	9.45	1.30
302.500	95.30	0.99979	0.9969	0.3059	9.29	1.30
297.500	100.30	0.99982	0.9981	0.3063	8.80	1.30
292.500	105.30	0.99983	0.9983	0.3063	8.76	1.30
287.500	110.30	0.99983	0.9984	0.3064	8.72	1.30
282.500	115.30	0.99983	0.9986	0.3064	8.68	1.30
277.500	120.30	0.99984	0.9987	0.3065	8.64	1.30
272.500	125.30	0.99984	0.9989	0.3065	8.60	1.30
267.500	130.30	0.99984	0.9990	0.3065	8.60	1.30
262.500	135.30	0.99984	0.9991	0.3066	8.54	1.30
257.500	140.30	0.99985	0.9992	0.3066	8.46	1.30

252.500	145.30	0.99985	0.9994	0.3067	8.38	1.30
247.500	150.30	0.99986	0.9995	0.3067	8.31	1.30
242.500	155.30	0.99986	0.9995	0.3067	8.30	1.30
237.500	160.30	0.99986	0.9996	0.3067	8.26	1.30
232.500	165.30	0.99987	0.9997	0.3068	8.10	1.30
227.500	170.30	0.99989	0.9998	0.3068	7.74	1.30
222.500	175.30	0.99991	0.9999	0.3068	7.37	1.30
217.500	180.30	0.99993	0.9999	0.3068	7.01	1.30
212.500	185.30	0.99995	1.0000	0.3068	6.58	1.30
207.500	190.30	0.99996	1.0000	0.3068	6.15	1.30
202.500	195.30	0.99998	1.0000	0.3069	5.73	1.30
197.500	200.30	0.99998	1.0000	0.3069	5.56	1.30
192.500	205.30	0.99998	1.0000	0.3069	5.50	1.30
187.500	210.30	0.99998	1.0000	0.3069	5.44	1.30
182.500	215.30	0.99998	1.0000	0.3069	5.37	1.30
177.500	220.30	0.99999	1.0000	0.3069	5.31	1.30
172.500	225.30	0.99999	1.0000	0.3069	5.25	1.30
167.500	230.30	0.99999	1.0000	0.3069	5.20	1.30
162.500	235.30	0.99999	1.0000	0.3069	5.17	1.30
157.500	240.30	0.99999	1.0000	0.3069	5.13	1.30
152.500	245.30	0.99999	1.0000	0.3069	5.10	1.30
147.500	250.30	0.99999	0.0000	0.0000	5.07	1.30
142.500	255.30	0.99999	0.0000	0.0000	5.04	1.30
137.500	260.30	0.99999	0.0000	0.0000	5.01	1.30
132.500	265.30	0.99999	0.0000	0.0000	5.00	1.33
127.500	270.30	0.99999	0.0000	0.0000	5.00	1.37
122.500	275.30	0.99999	0.0000	0.0000	5.00	1.42
117.500	280.30	0.99999	0.0000	0.0000	4.99	1.46
112.500	285.30	0.99999	0.0000	0.0000	4.96	1.51
107.500	290.30	0.99999	0.0000	0.0000	4.93	1.56
102.500	295.30	0.99999	0.0000	0.0000	4.90	1.60
97.500	300.30	0.99999	0.0000	0.0000	4.87	1.60
92.500	305.30	0.99999	0.0000	0.0000	4.84	1.60
87.500	310.30	0.99999	0.0000	0.0000	4.81	1.60
82.500	315.30	0.99999	0.0000	0.0000	4.80	1.60
77.500	320.30	0.99999	0.0000	0.0000	4.80	1.60
72.500	325.30	0.99999	0.0000	0.0000	4.80	1.60
67.500	330.30	0.99999	0.0000	0.0000	4.80	1.59
62.500	335.30	0.99999	0.0000	0.0000	4.80	1.56
57.500	340.30	0.99999	0.0000	0.0000	4.80	1.53
52.500	345.30	0.99999	0.0000	0.0000	4.80	1.50
47.500	350.30	0.99999	0.0000	0.0000	4.80	1.47
42.500	355.30	0.99999	0.0000	0.0000	4.80	1.44
37.500	360.30	0.99999	0.0000	0.0000	4.80	1.41
32.500	365.30	0.99999	0.0000	0.0000	4.80	1.41
27.500	370.30	0.99999	0.0000	0.0000	4.80	1.43
22.500	375.30	0.99999	0.0000	0.0000	4.80	1.45
17.500	380.30	0.99999	0.0000	0.0000	4.80	1.46
12.500	385.30	0.99999	0.0000	0.0000	4.80	1.48
7.500	390.30	0.99999	0.0000	0.0000	4.80	1.50
2.500	395.30	0.99999	0.0000	0.0000	4.80	1.50

COUGAR LAKE JULY 23, 1996 SELECT

INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR

UNITS ARE IN FEET

WEIR CREST ELEVATION 155.000
WEIR LENGTH 100.000
DISCHARGE, VOLUME FLOW PER SEC. 14.0000

TOTAL DISCHARGE, VOLUME PER SEC 14.0000

LOWER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM
154.697 ELEVATION 154.697
LOWER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE
BOTTOM 154.697 ELEVATION 154.697
UPPER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM
397.800 ELEVATION 397.800
UPPER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE
BOTTOM 397.800 ELEVATION 397.800
OUTFLOW DENSITY 0.99976 G/CC
OUTFLOW TEMPERATURE 8.81
OUTFLOW CONCENTRATION OF DISS ORGCARBON 1.27

Elevation	Depth	Density	Norm. Vel.	Flow	Temperature	Diss Org. C
396.400	1.40	0.99776	0.0000	0.0000	22.18	1.50
392.500	5.30	0.99777	0.0520	0.0159	22.12	1.48
387.500	10.30	0.99779	0.1048	0.0322	22.05	1.47
382.500	15.30	0.99807	0.3490	0.1071	20.76	1.45
377.500	20.30	0.99867	0.7062	0.2167	17.73	1.44
372.500	25.30	0.99891	0.8126	0.2493	16.35	1.42
367.500	30.30	0.99912	0.8833	0.2711	15.04	1.41
362.500	35.30	0.99927	0.9225	0.2831	14.05	1.38
357.500	40.30	0.99936	0.9447	0.2899	13.33	1.35
352.500	45.30	0.99947	0.9634	0.2956	12.50	1.32
347.500	50.30	0.99954	0.9744	0.2990	11.87	1.29
342.500	55.30	0.99960	0.9819	0.3013	11.30	1.26
337.500	60.30	0.99965	0.9869	0.3028	10.82	1.23
332.500	65.30	0.99968	0.9896	0.3037	10.52	1.20
327.500	70.30	0.99970	0.9915	0.3043	10.28	1.20
322.500	75.30	0.99972	0.9931	0.3047	10.05	1.20
317.500	80.30	0.99974	0.9944	0.3051	9.83	1.20
312.500	85.30	0.99976	0.9956	0.3055	9.60	1.20
307.500	90.30	0.99977	0.9963	0.3057	9.45	1.20
302.500	95.30	0.99979	0.9969	0.3059	9.29	1.20
297.500	100.30	0.99982	0.9981	0.3063	8.80	1.20
292.500	105.30	0.99983	0.9983	0.3063	8.76	1.20
287.500	110.30	0.99983	0.9984	0.3064	8.72	1.20
282.500	115.30	0.99983	0.9986	0.3064	8.68	1.20
277.500	120.30	0.99984	0.9987	0.3065	8.64	1.20
272.500	125.30	0.99984	0.9989	0.3065	8.60	1.20
267.500	130.30	0.99984	0.9990	0.3065	8.60	1.20
262.500	135.30	0.99984	0.9991	0.3066	8.54	1.20
257.500	140.30	0.99985	0.9992	0.3066	8.46	1.20

252.500	145.30	0.99985	0.9994	0.3067	8.38	1.20
247.500	150.30	0.99986	0.9995	0.3067	8.31	1.20
242.500	155.30	0.99986	0.9995	0.3067	8.30	1.20
237.500	160.30	0.99986	0.9996	0.3067	8.26	1.20
232.500	165.30	0.99987	0.9997	0.3068	8.10	1.20
227.500	170.30	0.99989	0.9998	0.3068	7.74	1.22
222.500	175.30	0.99991	0.9999	0.3068	7.37	1.23
217.500	180.30	0.99993	0.9999	0.3068	7.01	1.25
212.500	185.30	0.99995	1.0000	0.3068	6.58	1.26
207.500	190.30	0.99996	1.0000	0.3068	6.15	1.28
202.500	195.30	0.99998	1.0000	0.3069	5.73	1.30
197.500	200.30	0.99998	1.0000	0.3069	5.56	1.31
192.500	205.30	0.99998	1.0000	0.3069	5.50	1.33
187.500	210.30	0.99998	1.0000	0.3069	5.44	1.34
182.500	215.30	0.99998	1.0000	0.3069	5.37	1.36
177.500	220.30	0.99999	1.0000	0.3069	5.31	1.37
172.500	225.30	0.99999	1.0000	0.3069	5.25	1.39
167.500	230.30	0.99999	1.0000	0.3069	5.20	1.40
162.500	235.30	0.99999	1.0000	0.3069	5.17	1.38
157.500	240.30	0.99999	1.0000	0.3069	5.13	1.37
152.500	245.30	0.99999	1.0000	0.3069	5.10	1.35
147.500	250.30	0.99999	0.0000	0.0000	5.07	1.34
142.500	255.30	0.99999	0.0000	0.0000	5.04	1.32
137.500	260.30	0.99999	0.0000	0.0000	5.01	1.31
132.500	265.30	0.99999	0.0000	0.0000	5.00	1.44
127.500	270.30	0.99999	0.0000	0.0000	5.00	1.69
122.500	275.30	0.99999	0.0000	0.0000	5.00	1.93
117.500	280.30	0.99999	0.0000	0.0000	4.99	2.17
112.500	285.30	0.99999	0.0000	0.0000	4.96	2.42
107.500	290.30	0.99999	0.0000	0.0000	4.93	2.66
102.500	295.30	0.99999	0.0000	0.0000	4.90	2.90
97.500	300.30	0.99999	0.0000	0.0000	4.87	2.68
92.500	305.30	0.99999	0.0000	0.0000	4.84	2.47
87.500	310.30	0.99999	0.0000	0.0000	4.81	2.26
82.500	315.30	0.99999	0.0000	0.0000	4.80	2.04
77.500	320.30	0.99999	0.0000	0.0000	4.80	1.83
72.500	325.30	0.99999	0.0000	0.0000	4.80	1.62
67.500	330.30	0.99999	0.0000	0.0000	4.80	1.50
62.500	335.30	0.99999	0.0000	0.0000	4.80	1.49
57.500	340.30	0.99999	0.0000	0.0000	4.80	1.48
52.500	345.30	0.99999	0.0000	0.0000	4.80	1.47
47.500	350.30	0.99999	0.0000	0.0000	4.80	1.46
42.500	355.30	0.99999	0.0000	0.0000	4.80	1.46
37.500	360.30	0.99999	0.0000	0.0000	4.80	1.45
32.500	365.30	0.99999	0.0000	0.0000	4.80	1.44
27.500	370.30	0.99999	0.0000	0.0000	4.80	1.43
22.500	375.30	0.99999	0.0000	0.0000	4.80	1.42
17.500	380.30	0.99999	0.0000	0.0000	4.80	1.42
12.500	385.30	0.99999	0.0000	0.0000	4.80	1.41
7.500	390.30	0.99999	0.0000	0.0000	4.80	1.40
2.500	395.30	0.99999	0.0000	0.0000	4.80	1.40

```
1000 ***COUGAR LAKE AUGUST 27, 1996 SELECT
1010 ***DATA SETS 01
1020 ***PRINT INPUT
1030 ***INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR
1040 ***ENGLISH
1050 ***TABLE 01
1060 ***THICKNESS 5.0
1070 ***INTERVAL 01
1080 ***SURFACE 365.0
1090 ***BOTTOM 0.0
1100 ***WEIR
1110 ***SUBMERGED
1120 ***LENGTH 100.
1130 ***HEIGHT 155.0
1140 ***FLOW 31.7
1150 ***NUMBER OF TEMP 39
1160 ***TEMPERATURE DEGREES CENTIGRADE
1170 ***HEIGHT TEMP
1180 *** 365.0 21.0
1190 *** 358.4 21.0
1200 *** 351.9 21.0
1210 *** 345.3 20.1
1220 *** 338.8 18.6
1230 *** 332.2 16.6
1240 *** 325.6 15.7
1250 *** 319.1 15.1
1260 *** 312.5 14.6
1270 *** 306.0 14.1
1280 *** 299.4 13.6
1290 *** 292.8 12.7
1300 *** 286.3 12.2
1310 *** 279.7 11.7
1320 *** 273.1 11.2
1330 *** 266.6 10.8
1340 *** 260.0 10.5
1350 *** 253.5 10.3
1360 *** 246.9 10.0
1370 *** 240.3 9.8
1380 *** 233.8 9.4
1390 *** 227.2 9.0
1400 *** 220.7 8.6
1410 *** 214.1 8.0
1420 *** 207.5 6.5
1430 *** 201.0 5.9
1440 *** 194.4 5.6
1450 *** 187.8 5.0
1460 *** 181.3 4.9
1470 *** 174.7 4.9
1480 *** 168.2 4.9
1490 *** 141.9 4.9
1500 *** 115.7 4.8
1510 *** 96.0 4.8
1520 *** 76.3 4.8
```

1530	***	63.2	4.8
1540	***	50.0	4.8
1550	***	23.8	4.8
1560	***	13.9	4.8
1570	***	QUALITIES	1
1580	***	NUMBER OF DISSOLVED OXYGEN	39
1590	***	HEIGHT	DISSOLVED OXYGEN
1600	***	365.0	8.7
1610	***	358.4	8.7
1620	***	351.9	8.7
1630	***	345.3	11.1
1640	***	338.8	12.2
1650	***	332.2	12.7
1660	***	325.6	11.5
1670	***	319.1	10.4
1680	***	312.5	9.6
1690	***	306.0	9.1
1700	***	299.4	8.8
1710	***	292.8	8.5
1720	***	286.3	8.3
1730	***	279.7	8.6
1740	***	273.1	8.5
1750	***	266.6	8.3
1760	***	260.0	8.2
1770	***	253.5	8.4
1780	***	246.9	8.7
1790	***	240.3	8.8
1800	***	233.8	9.0
1810	***	227.2	9.1
1820	***	220.7	9.2
1830	***	214.1	9.2
1840	***	207.5	8.9
1850	***	201.0	9.1
1860	***	194.4	9.6
1870	***	187.8	10.0
1880	***	181.3	10.1
1890	***	174.7	10.0
1900	***	168.2	9.9
1910	***	141.9	10.1
1920	***	115.7	10.0
1930	***	96.0	9.7
1940	***	76.3	9.1
1950	***	63.2	8.1
1960	***	50.0	6.5
1970	***	23.8	5.0
1980	***	13.9	4.3
1990	***	STOP	

COUGAR LAKE AUGUST 27, 1996 SELECT
INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR
UNITS ARE IN FEET

WEIR CREST ELEVATION 155.000
WEIR LENGTH 100.000
DISCHARGE, VOLUME FLOW PER SEC. 31.0000

TOTAL DISCHARGE, VOLUME PER SEC 31.0000

LOWER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM
141.982 ELEVATION 141.982
LOWER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM
141.982 ELEVATION 141.982
UPPER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM
365.000 ELEVATION 365.000
UPPER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM
365.000 ELEVATION 365.000
OUTFLOW DENSITY 0.99966 G/CC
OUTFLOW TEMPERATURE 9.57
OUTFLOW CONCENTRATION OF DISSOLVED OXYGEN 9.44

1

Elevation	Depth	Density	Norm. Vel.	Flow	Temperature	Diss. Oxygen
362.500	2.50	0.99802	0.0000	0.0000	21.00	8.70
357.500	7.50	0.99802	0.0449	0.0355	21.00	8.70
352.500	12.50	0.99802	0.0888	0.0702	21.00	8.70
347.500	17.50	0.99815	0.2409	0.1904	20.40	10.30
342.500	22.50	0.99834	0.4219	0.3334	19.45	11.57
337.500	27.50	0.99859	0.5998	0.4740	18.21	12.30
332.500	32.50	0.99886	0.7522	0.5944	16.69	12.68
327.500	37.50	0.99898	0.8126	0.6421	15.96	11.85
322.500	42.50	0.99907	0.8516	0.6729	15.41	10.98
317.500	47.50	0.99913	0.8791	0.6946	14.98	10.21
312.500	52.50	0.99919	0.9003	0.7113	14.60	9.60
307.500	57.50	0.99924	0.9185	0.7257	14.22	9.22
302.500	62.50	0.99930	0.9338	0.7378	13.83	8.94
297.500	67.50	0.99936	0.9491	0.7499	13.34	8.71
292.500	72.50	0.99945	0.9642	0.7618	12.68	8.49
287.500	77.50	0.99949	0.9719	0.7680	12.29	8.34
282.500	82.50	0.99954	0.9782	0.7729	11.91	8.47
277.500	87.50	0.99958	0.9833	0.7769	11.53	8.57
272.500	92.50	0.99962	0.9873	0.7801	11.16	8.48
267.500	97.50	0.99965	0.9901	0.7823	10.86	8.33
262.500	102.50	0.99967	0.9921	0.7839	10.61	8.24
257.500	107.50	0.99969	0.9935	0.7850	10.42	8.28
252.500	112.50	0.99971	0.9947	0.7859	10.25	8.45
247.500	117.50	0.99973	0.9958	0.7868	10.03	8.67
242.500	122.50	0.99974	0.9966	0.7874	9.87	8.77
237.500	127.50	0.99976	0.9974	0.7881	9.63	8.89
232.500	132.50	0.99978	0.9981	0.7887	9.32	9.02
227.500	137.50	0.99981	0.9987	0.7891	9.02	9.10
222.500	142.50	0.99983	0.9991	0.7894	8.71	9.17

217.500	147.50	0.99986	0.9994	0.7897	8.31	9.20
212.500	152.50	0.99990	0.9998	0.7899	7.64	9.13
207.500	157.50	0.99995	1.0000	0.7901	6.50	8.90
202.500	162.50	0.99997	1.0000	0.7901	6.04	9.05
197.500	167.50	0.99998	1.0000	0.7901	5.74	9.37
192.500	172.50	0.99998	1.0000	0.7901	5.43	9.72
187.500	177.50	0.99999	1.0000	0.7901	5.00	10.00
182.500	182.50	0.99999	1.0000	0.7901	4.92	10.08
177.500	187.50	0.99999	1.0000	0.7901	4.90	10.04
172.500	192.50	0.99999	1.0000	0.7901	4.90	9.97
167.500	197.50	0.99999	1.0000	0.7901	4.90	9.91
162.500	202.50	0.99999	1.0000	0.7901	4.90	9.94
157.500	207.50	0.99999	1.0000	0.7901	4.90	9.98
152.500	212.50	0.99999	1.0000	0.7901	4.90	10.02
147.500	217.50	0.99999	1.0000	0.7901	4.90	10.06
142.500	222.50	0.99999	1.0000	0.7901	4.90	10.10
137.500	227.50	0.99999	0.0000	0.0000	4.88	10.08
132.500	232.50	0.99999	0.0000	0.0000	4.86	10.06
127.500	237.50	0.99999	0.0000	0.0000	4.85	10.05
122.500	242.50	0.99999	0.0000	0.0000	4.83	10.03
117.500	247.50	0.99999	0.0000	0.0000	4.81	10.01
112.500	252.50	0.99999	0.0000	0.0000	4.80	9.95
107.500	257.50	0.99999	0.0000	0.0000	4.80	9.88
102.500	262.50	0.99999	0.0000	0.0000	4.80	9.80
97.500	267.50	0.99999	0.0000	0.0000	4.80	9.72
92.500	272.50	0.99999	0.0000	0.0000	4.80	9.59
87.500	277.50	0.99999	0.0000	0.0000	4.80	9.44
82.500	282.50	0.99999	0.0000	0.0000	4.80	9.29
77.500	287.50	0.99999	0.0000	0.0000	4.80	9.14
72.500	292.50	0.99999	0.0000	0.0000	4.80	8.81
67.500	297.50	0.99999	0.0000	0.0000	4.80	8.43
62.500	302.50	0.99999	0.0000	0.0000	4.80	8.02
57.500	307.50	0.99999	0.0000	0.0000	4.80	7.41
52.500	312.50	0.99999	0.0000	0.0000	4.80	6.80
47.500	317.50	0.99999	0.0000	0.0000	4.80	6.36
42.500	322.50	0.99999	0.0000	0.0000	4.80	6.07
37.500	327.50	0.99999	0.0000	0.0000	4.80	5.78
32.500	332.50	0.99999	0.0000	0.0000	4.80	5.50
27.500	337.50	0.99999	0.0000	0.0000	4.80	5.21
22.500	342.50	0.99999	0.0000	0.0000	4.80	4.91
17.500	347.50	0.99999	0.0000	0.0000	4.80	4.55
12.500	352.50	0.99999	0.0000	0.0000	4.80	4.30
7.500	357.50	0.99999	0.0000	0.0000	4.80	4.30
2.500	362.50	0.99999	0.0000	0.0000	4.80	4.30

	VELOCITY (TIMES 1000)										
	0	200	400	600	800	1000	1200	1400	1600	1800	2000
	I	I	I	I	I	I	I	I	I	I	I
365.00	0.00	+	*	D							
360.00	5.00	+	D	V							
355.00	10.00	+	D	V							
350.00	15.00	+	D		V						
345.00	20.00	+	D		V						
340.00	25.00	+	D		V						
335.00	30.00	+	D		V						
330.00	35.00	+	D		V						
325.00	40.00	+	D		V						
320.00	45.00	+	D		V						
315.00	50.00	+	D		V						
310.00	55.00	+	D		V						
305.00	60.00	+	D		V						
300.00	65.00	+	D		V						
295.00	70.00	+	D		V						
290.00	75.00	+	D		V						
285.00	80.00	+	D		V						
280.00	85.00	+	D		V						
275.00	90.00	+	D		V						
270.00	95.00	+	D		V						
265.00	100.00	+	D		V						
260.00	105.00	+	D		V						
255.00	110.00	+	D		V						
250.00	115.00	+	D		V						
245.00	120.00	+	D		V						
240.00	125.00	+	D		V						
235.00	130.00	+	D		V						
230.00	135.00	+	D		V						
225.00	140.00	+	D		V						
220.00	145.00	+	D		V						
215.00	150.00	+	D		V						
210.00	155.00	+	D		V						
205.00	160.00	+	D		V						
200.00	165.00	+	D		V						
195.00	170.00	+	D		V						
190.00	175.00	+	D		V						
185.00	180.00	+	D		V						
180.00	185.00	+	D		V						
175.00	190.00	+	D		V						
170.00	195.00	+	D		V						
165.00	200.00	+	D		V						
160.00	205.00	+	D		V						
155.00	210.00	+	D		V						
150.00	215.00	+	D		V						
145.00	220.00	+	D		V						
140.00	225.00	+	D		V						
135.00	230.00	+	D		V						
130.00	235.00	+	D		V						

125.00	240.00	+	*	D
120.00	245.00	+	*	D
115.00	250.00	+	*	D
110.00	255.00	+	*	D
105.00	260.00	+	*	D
100.00	265.00	+	*	D
95.00	270.00	+	*	D
90.00	275.00	+	*	D
85.00	280.00	+	*	D
80.00	285.00	+	*	D
75.00	290.00	+	*	D
70.00	295.00	+	*	D
65.00	300.00	+	*	D
60.00	305.00	+	*	D
55.00	310.00	+	*	D
50.00	315.00	+	*	D
45.00	320.00	+	*	D
40.00	325.00	+	*	D
35.00	330.00	+	*	D
30.00	335.00	+	*	D
25.00	340.00	+	*	D
20.00	345.00	+	*	D
15.00	350.00	+	*	D
10.00	355.00	+	*	D
5.00	360.00	+	*	D

I-----I-----I-----I-----I-----I-----I-----I-----I-----I
0.99800 0.99900 1.00000 1.00100 1.00200 1.00300 1.00400 1.00500 1.00600
1.00700 1.00800

DENSITY G/CC

COUGAR LAKE AUGUST 28, 1996 SELECT

INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR

UNITS ARE IN FEET

WEIR CREST ELEVATION 155.000

WEIR LENGTH 100.000

DISCHARGE, VOLUME FLOW PER SEC. 31.0000

TOTAL DISCHARGE, VOLUME PER SEC 31.0000

LOWER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM

141.982 ELEVATION 141.982

LOWER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM

141.982 ELEVATION 141.982

UPPER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM

365.000 ELEVATION 365.000

UPPER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM

365.000 ELEVATION 365.000

OUTFLOW DENSITY 0.99966 G/CC

OUTFLOW TEMPERATURE 9.57

OUTFLOW CONCENTRATION OF TOTAL ORG CARB0.64

Elevation	Depth	Density	Norm. Vel.	Flow	Temperature	Total Org. C
362.500	2.50	0.99802	0.0000	0.0000	21.00	0.69
357.500	7.50	0.99802	0.0449	0.0355	21.00	0.68
352.500	12.50	0.99802	0.0888	0.0702	21.00	0.66
347.500	17.50	0.99815	0.2409	0.1904	20.40	0.65
342.500	22.50	0.99834	0.4219	0.3334	19.45	0.63
337.500	27.50	0.99859	0.5998	0.4740	18.21	0.62
332.500	32.50	0.99886	0.7522	0.5944	16.69	0.60
327.500	37.50	0.99898	0.8126	0.6421	15.96	0.56
322.500	42.50	0.99907	0.8516	0.6729	15.41	0.51
317.500	47.50	0.99913	0.8791	0.6946	14.98	0.47
312.500	52.50	0.99919	0.9003	0.7113	14.60	0.42
307.500	57.50	0.99924	0.9185	0.7257	14.22	0.37
302.500	62.50	0.99930	0.9338	0.7378	13.83	0.33
297.500	67.50	0.99936	0.9491	0.7499	13.34	0.32
292.500	72.50	0.99945	0.9642	0.7618	12.68	0.36
287.500	77.50	0.99949	0.9719	0.7680	12.29	0.41
282.500	82.50	0.99954	0.9782	0.7729	11.91	0.45
277.500	87.50	0.99958	0.9833	0.7769	11.53	0.50
272.500	92.50	0.99962	0.9873	0.7801	11.16	0.55
267.500	97.50	0.99965	0.9901	0.7823	10.86	0.59
262.500	102.50	0.99967	0.9921	0.7839	10.61	0.60
257.500	107.50	0.99969	0.9935	0.7850	10.42	0.60
252.500	112.50	0.99971	0.9947	0.7859	10.25	0.60
247.500	117.50	0.99973	0.9958	0.7868	10.03	0.60
242.500	122.50	0.99974	0.9966	0.7874	9.87	0.60
237.500	127.50	0.99976	0.9974	0.7881	9.63	0.60
232.500	132.50	0.99978	0.9981	0.7887	9.32	0.60
227.500	137.50	0.99981	0.9987	0.7891	9.02	0.58
222.500	142.50	0.99983	0.9991	0.7894	8.71	0.57

217.500	147.50	0.99986	0.9994	0.7897	8.31	0.55
212.500	152.50	0.99990	0.9998	0.7899	7.64	0.54
207.500	157.50	0.99995	1.0000	0.7901	6.50	0.52
202.500	162.50	0.99997	1.0000	0.7901	6.04	0.50
197.500	167.50	0.99998	1.0000	0.7901	5.74	0.57
192.500	172.50	0.99998	1.0000	0.7901	5.43	0.68
187.500	177.50	0.99999	1.0000	0.7901	5.00	0.79
182.500	182.50	0.99999	1.0000	0.7901	4.92	0.89
177.500	187.50	0.99999	1.0000	0.7901	4.90	1.00
172.500	192.50	0.99999	1.0000	0.7901	4.90	1.11
167.500	197.50	0.99999	1.0000	0.7901	4.90	1.19
162.500	202.50	0.99999	1.0000	0.7901	4.90	1.11
157.500	207.50	0.99999	1.0000	0.7901	4.90	1.04
152.500	212.50	0.99999	1.0000	0.7901	4.90	0.96
147.500	217.50	0.99999	1.0000	0.7901	4.90	0.88
142.500	222.50	0.99999	1.0000	0.7901	4.90	0.81
137.500	227.50	0.99999	0.0000	0.0000	4.88	0.73
132.500	232.50	0.99999	0.0000	0.0000	4.86	0.70
127.500	237.50	0.99999	0.0000	0.0000	4.85	0.70
122.500	242.50	0.99999	0.0000	0.0000	4.83	0.70
117.500	247.50	0.99999	0.0000	0.0000	4.81	0.70
112.500	252.50	0.99999	0.0000	0.0000	4.80	0.70
107.500	257.50	0.99999	0.0000	0.0000	4.80	0.70
102.500	262.50	0.99999	0.0000	0.0000	4.80	0.70
97.500	267.50	0.99999	0.0000	0.0000	4.80	1.86
92.500	272.50	0.99999	0.0000	0.0000	4.80	3.02
87.500	277.50	0.99999	0.0000	0.0000	4.80	4.18
82.500	282.50	0.99999	0.0000	0.0000	4.80	5.33
77.500	287.50	0.99999	0.0000	0.0000	4.80	6.49
72.500	292.50	0.99999	0.0000	0.0000	4.80	7.65
67.500	297.50	0.99999	0.0000	0.0000	4.80	7.86
62.500	302.50	0.99999	0.0000	0.0000	4.80	6.85
57.500	307.50	0.99999	0.0000	0.0000	4.80	5.85
52.500	312.50	0.99999	0.0000	0.0000	4.80	4.84
47.500	317.50	0.99999	0.0000	0.0000	4.80	3.83
42.500	322.50	0.99999	0.0000	0.0000	4.80	2.83
37.500	327.50	0.99999	0.0000	0.0000	4.80	1.82
32.500	332.50	0.99999	0.0000	0.0000	4.80	1.70
27.500	337.50	0.99999	0.0000	0.0000	4.80	1.70
22.500	342.50	0.99999	0.0000	0.0000	4.80	1.70
17.500	347.50	0.99999	0.0000	0.0000	4.80	1.70
12.500	352.50	0.99999	0.0000	0.0000	4.80	1.70
7.500	357.50	0.99999	0.0000	0.0000	4.80	1.70
2.500	362.50	0.99999	0.0000	0.0000	4.80	1.70

COUGAR LAKE AUGUST 27, 1996 SELECT

INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR

UNITS ARE IN FEET

WEIR CREST ELEVATION 155.000

WEIR LENGTH 100.000

DISCHARGE, VOLUME FLOW PER SEC. 31.0000

TOTAL DISCHARGE, VOLUME PER SEC 31.0000

LOWER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM

141.982 ELEVATION 141.982

LOWER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM

141.982 ELEVATION 141.982

UPPER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM

365.000 ELEVATION 365.000

UPPER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM

365.000 ELEVATION 365.000

OUTFLOW DENSITY 0.99966 G/CC

OUTFLOW TEMPERATURE 9.57

OUTFLOW CONCENTRATION OF DISSOLVED ORGANIC CARBON 0.57

Elevation	Depth	Density	Norm. Vel.	Flow	Temperature	Diss. Org. C.
362.500	2.50	0.99802	0.0000	0.0000	21.00	0.59
357.500	7.50	0.99802	0.0449	0.0355	21.00	0.58
352.500	12.50	0.99802	0.0888	0.0702	21.00	0.56
347.500	17.50	0.99815	0.2409	0.1904	20.40	0.55
342.500	22.50	0.99834	0.4219	0.3334	19.45	0.53
337.500	27.50	0.99859	0.5998	0.4740	18.21	0.52
332.500	32.50	0.99886	0.7522	0.5944	16.69	0.50
327.5	37.50	0.99898	0.8126	0.6421	15.96	0.46
322.5	42.50	0.99907	0.8516	0.6729	15.41	0.41
317.500	47.50	0.99913	0.8791	0.6946	14.98	0.37
312.500	52.50	0.99919	0.9003	0.7113	14.60	0.32
307.500	57.50	0.99924	0.9185	0.7257	14.22	0.27
302.500	62.50	0.99930	0.9338	0.7378	13.83	0.23
297.500	67.50	0.99936	0.9491	0.7499	13.34	0.22
292.500	72.50	0.99945	0.9642	0.7618	12.68	0.26
287.500	77.50	0.99949	0.9719	0.7680	12.29	0.31
282.500	82.50	0.99954	0.9782	0.7729	11.91	0.35
277.500	87.50	0.99958	0.9833	0.7769	11.53	0.40
272.500	92.50	0.99962	0.9873	0.7801	11.16	0.45
267.500	97.50	0.99965	0.9901	0.7823	10.86	0.49
262.500	102.50	0.99967	0.9921	0.7839	10.61	0.54
257.500	107.50	0.99969	0.9935	0.7850	10.42	0.58
252.500	112.50	0.99971	0.9947	0.7859	10.25	0.63
247.500	117.50	0.99973	0.9958	0.7868	10.03	0.67
242.500	122.50	0.99974	0.9966	0.7874	9.87	0.72
237.500	127.50	0.99976	0.9974	0.7881	9.63	0.77

232.500	132.50	0.99978	0.9981	0.7887	9.32	0.80
227.500	137.50	0.99981	0.9987	0.7891	9.02	0.78
222.500	142.50	0.99983	0.9991	0.7894	8.71	0.77
217.500	147.50	0.99986	0.9994	0.7897	8.31	0.75
212.500	152.50	0.99990	0.9998	0.7899	7.64	0.74
207.500	157.50	0.99995	1.0000	0.7901	6.50	0.72
202.500	162.50	0.99997	1.0000	0.7901	6.04	0.70
197.500	167.50	0.99998	1.0000	0.7901	5.74	0.69
192.500	172.50	0.99998	1.0000	0.7901	5.43	0.67
187.500	177.50	0.99999	1.0000	0.7901	5.00	0.66
182.500	182.50	0.99999	1.0000	0.7901	4.92	0.64
177.500	187.50	0.99999	1.0000	0.7901	4.90	0.63
172.500	192.50	0.99999	1.0000	0.7901	4.90	0.61
167.500	197.50	0.99999	1.0000	0.7901	4.90	0.60
162.500	202.50	0.99999	1.0000	0.7901	4.90	0.62
157.500	207.50	0.99999	1.0000	0.7901	4.90	0.63
152.500	212.50	0.99999	1.0000	0.7901	4.90	0.65
147.500	217.50	0.99999	1.0000	0.7901	4.90	0.66
142.500	222.50	0.99999	1.0000	0.7901	4.90	0.68
137.500	227.50	0.99999	0.0000	0.0000	4.88	0.69
132.500	232.50	0.99999	0.0000	0.0000	4.86	0.70
127.500	237.50	0.99999	0.0000	0.0000	4.85	0.70
122.500	242.50	0.99999	0.0000	0.0000	4.83	0.70
117.500	247.50	0.99999	0.0000	0.0000	4.81	0.70
112.500	252.50	0.99999	0.0000	0.0000	4.80	0.70
107.500	257.50	0.99999	0.0000	0.0000	4.80	0.70
102.500	262.50	0.99999	0.0000	0.0000	4.80	0.70
97.500	267.50	0.99999	0.0000	0.0000	4.80	0.73
92.500	272.50	0.99999	0.0000	0.0000	4.80	0.76
87.500	277.50	0.99999	0.0000	0.0000	4.80	0.79
82.500	282.50	0.99999	0.0000	0.0000	4.80	0.82
77.500	287.50	0.99999	0.0000	0.0000	4.80	0.85
72.500	292.50	0.99999	0.0000	0.0000	4.80	0.88
67.500	297.50	0.99999	0.0000	0.0000	4.80	0.89
62.500	302.50	0.99999	0.0000	0.0000	4.80	0.88
57.500	307.50	0.99999	0.0000	0.0000	4.80	0.86
52.500	312.50	0.99999	0.0000	0.0000	4.80	0.85
47.500	317.50	0.99999	0.0000	0.0000	4.80	0.83
42.500	322.50	0.99999	0.0000	0.0000	4.80	0.82
37.500	327.50	0.99999	0.0000	0.0000	4.80	0.80
32.500	332.50	0.99999	0.0000	0.0000	4.80	0.80
27.500	337.50	0.99999	0.0000	0.0000	4.80	0.80
22.500	342.50	0.99999	0.0000	0.0000	4.80	0.80
17.500	347.50	0.99999	0.0000	0.0000	4.80	0.80
12.500	352.50	0.99999	0.0000	0.0000	4.80	0.80
7.500	357.50	0.99999	0.0000	0.0000	4.80	0.80
2.500	362.50	0.99999	0.0000	0.0000	4.80	0.80

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1000 ***COUGAR LAKE SEPTEMBER 25, 1996 SELECT
1010 ***DATA SETS 01
1020 ***PRINT INPUT
1030 ***INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR
1040 ***ENGLISH
1050 ***TABLE 01
1060 ***THICKNESS 5.0
1070 ***INTERVAL 01
1080 ***SURFACE 333.0
1090 ***BOTTOM 0.0
1100 ***WEIR
1110 ***SUBMERGED
1120 ***LENGTH 100.
1130 ***HEIGHT 155.0
1140 ***FLOW 25
1150 ***NUMBER OF TEMP 37
1160 ***TEMPERATURE DEGREES CENTIGRADE
1170 ***HEIGHT TEMP
1180 *** 333.0 16.6
1190 *** 326.5 16.6
1200 *** 319.9 16.6
1210 *** 313.4 16.5
1220 *** 306.8 16.5
1230 *** 300.2 16.5
1240 *** 293.7 16.4
1250 *** 287.1 15.2
1260 *** 280.6 14.7
1270 *** 274.0 14.4
1280 *** 267.4 14.3
1290 *** 260.9 14.1
1300 *** 254.3 13.8
1310 *** 247.7 13.6
1320 *** 241.2 13.4
1330 *** 234.6 13.2
1340 *** 228.1 12.8
1350 *** 221.5 12.1
1360 *** 214.9 10.0
1370 *** 208.4 7.4
1380 *** 201.8 6.1
1390 *** 195.3 5.5
1400 *** 188.7 5.4
1410 *** 182.1 5.4
1420 *** 175.6 5.3
1430 *** 169.0 5.3
1440 *** 162.4 5.2
1450 *** 155.9 5.2
1460 *** 149.3 5.1
1470 *** 142.8 5.1
1480 *** 123.1 5.0
1490 *** 96.8 5.0
1500 *** 77.1 4.9
1510 *** 64.0 4.9
1520 *** 50.9 4.9

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1530	***	37.8	4.9
1540	***	18.1	4.9
1550	***	QUALITIES	1
1560	***	NUMBER OF DISSOLVED OXYGEN	37
1570	***	HEIGHT	DISSOLVED OXYGEN
1580	***	333.0	9.8
1590	***	326.5	9.7
1600	***	319.9	9.7
1610	***	313.4	9.7
1620	***	306.8	9.7
1630	***	300.2	9.7
1640	***	293.7	9.6
1650	***	287.1	9.2
1660	***	280.6	8.9
1670	***	274.0	8.8
1680	***	267.4	8.5
1690	***	260.9	8.8
1700	***	254.3	8.5
1710	***	247.7	8.5
1720	***	241.2	8.7
1730	***	234.6	8.7
1740	***	228.1	8.4
1750	***	221.5	8.1
1760	***	214.9	7.8
1770	***	208.4	8.4
1780	***	201.8	9.1
1790	***	195.3	9.7
1800	***	188.7	9.8
1810	***	182.1	10.0
1820	***	175.6	9.9
1830	***	169.0	10.0
1840	***	162.4	9.9
1850	***	155.9	9.9
1860	***	149.3	10.0
1870	***	142.8	10.0
1880	***	123.1	10.0
1890	***	96.8	9.3
1900	***	77.1	8.8
1910	***	64.0	8.1
1920	***	50.9	7.0
1930	***	37.8	5.2
1940	***	18.1	2.0
1950	***	STOP	

COUGAR LAKE SEPTEMBER 25, 1996 SELECT
INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR

UNITS ARE IN FEET

WEIR CREST ELEVATION 155.000

WEIR LENGTH 100.000

DISCHARGE, VOLUME FLOW PER SEC. 25.0000

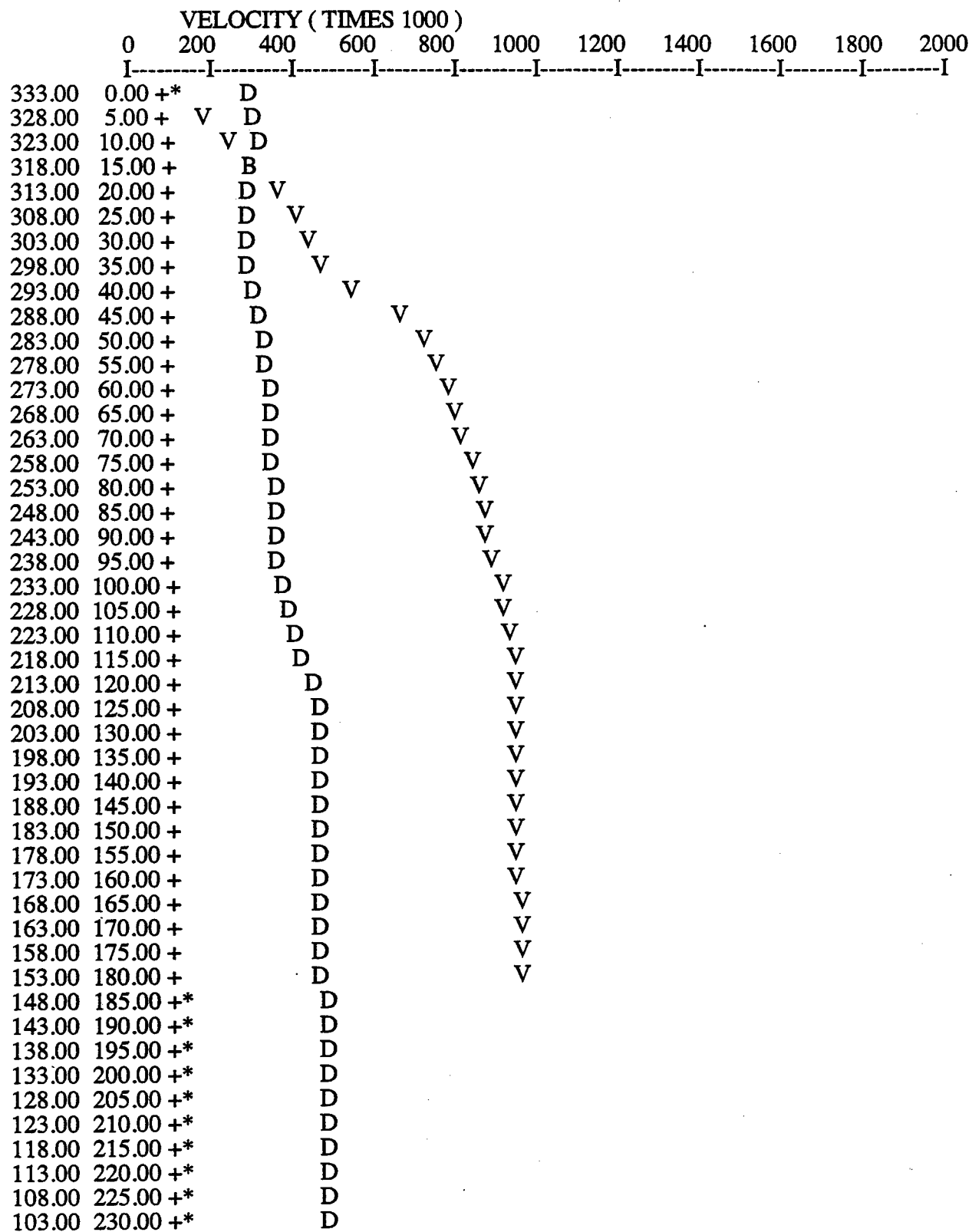
TOTAL DISCHARGE, VOLUME PER SEC 25.0000

154.697 LOWER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM
ELEVATION 154.697
154.697 LOWER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM
ELEVATION 154.697
333.000 UPPER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM
ELEVATION 333.000
333.000 UPPER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM
ELEVATION 333.000
OUTFLOW DENSITY 0.99960 G/CC
OUTFLOW TEMPERATURE 10.15
OUTFLOW CONCENTRATION OF DISSOLVED OXYGEN 9.11

1

Elevation	Depth	Density	Norm. Vel.	Flow	Temperature	Diss. Oxygen
331.500	1.50	0.99887	0.0000	0.0000	16.60	9.78
327.500	5.50	0.99887	0.0548	0.0491	16.60	9.72
322.500	10.50	0.99887	0.1080	0.0968	16.60	9.70
317.500	15.50	0.99888	0.1691	0.1515	16.56	9.70
312.500	20.50	0.99889	0.2336	0.2092	16.50	9.70
307.500	25.50	0.99889	0.2807	0.2515	16.50	9.70
302.500	30.50	0.99889	0.3264	0.2923	16.50	9.70
297.500	35.50	0.99890	0.3785	0.3390	16.46	9.66
292.500	40.50	0.99894	0.4683	0.4195	16.18	9.53
287.500	45.50	0.99909	0.6328	0.5668	15.27	9.22
282.500	50.50	0.99915	0.7065	0.6328	14.85	8.99
277.500	55.50	0.99919	0.7553	0.6766	14.56	8.85
272.500	60.50	0.99922	0.7892	0.7069	14.38	8.73
267.500	65.50	0.99923	0.8118	0.7271	14.30	8.50
262.500	70.50	0.99925	0.8374	0.7501	14.15	8.73
257.500	75.50	0.99928	0.8631	0.7731	13.95	8.65
252.500	80.50	0.99931	0.8852	0.7929	13.75	8.50
247.500	85.50	0.99933	0.9025	0.8084	13.59	8.51
242.500	90.50	0.99935	0.9178	0.8221	13.44	8.66
237.500	95.50	0.99937	0.9312	0.8341	13.29	8.70
232.500	100.50	0.99940	0.9444	0.8460	13.07	8.60
227.500	105.50	0.99944	0.9578	0.8580	12.74	8.37
222.500	110.50	0.99950	0.9713	0.8700	12.21	8.15
217.500	115.50	0.99965	0.9880	0.8850	10.83	7.92
212.500	120.50	0.99981	0.9970	0.8931	9.04	8.02
207.500	125.50	0.99992	0.9996	0.8954	7.22	8.50
202.500	130.50	0.99996	0.9999	0.8957	6.24	9.03
197.500	135.50	0.99998	1.0000	0.8957	5.70	9.50
192.500	140.50	0.99998	1.0000	0.8957	5.46	9.74

187.500	145.50	0.99998	1.0000	0.8957	5.40	9.84
182.500	150.50	0.99998	1.0000	0.8957	5.40	9.99
177.500	155.50	0.99999	1.0000	0.8957	5.33	9.93
172.500	160.50	0.99999	1.0000	0.8957	5.30	9.95
167.500	165.50	0.99999	1.0000	0.8957	5.28	9.98
162.500	170.50	0.99999	1.0000	0.8957	5.20	9.90
157.500	175.50	0.99999	1.0000	0.8957	5.20	9.90
152.500	180.50	0.99999	1.0000	0.8957	5.15	9.95
147.500	185.50	0.99999	0.0000	0.0000	5.10	10.00
142.500	190.50	0.99999	0.0000	0.0000	5.10	10.00
137.500	195.50	0.99999	0.0000	0.0000	5.07	10.00
132.500	200.50	0.99999	0.0000	0.0000	5.05	10.00
127.500	205.50	0.99999	0.0000	0.0000	5.02	10.00
122.500	210.50	0.99999	0.0000	0.0000	5.00	9.98
117.500	215.50	0.99999	0.0000	0.0000	5.00	9.85
112.500	220.50	0.99999	0.0000	0.0000	5.00	9.72
107.500	225.50	0.99999	0.0000	0.0000	5.00	9.58
102.500	230.50	0.99999	0.0000	0.0000	5.00	9.45
97.500	235.50	0.99999	0.0000	0.0000	5.00	9.32
92.500	240.50	0.99999	0.0000	0.0000	4.98	9.19
87.500	245.50	0.99999	0.0000	0.0000	4.95	9.06
82.500	250.50	0.99999	0.0000	0.0000	4.93	8.94
77.500	255.50	0.99999	0.0000	0.0000	4.90	8.81
72.500	260.50	0.99999	0.0000	0.0000	4.90	8.55
67.500	265.50	0.99999	0.0000	0.0000	4.90	8.29
62.500	270.50	0.99999	0.0000	0.0000	4.90	7.97
57.500	275.50	0.99999	0.0000	0.0000	4.90	7.55
52.500	280.50	0.99999	0.0000	0.0000	4.90	7.13
47.500	285.50	0.99999	0.0000	0.0000	4.90	6.53
42.500	290.50	0.99999	0.0000	0.0000	4.90	5.85
37.500	295.50	0.99999	0.0000	0.0000	4.90	5.15
32.500	300.50	0.99999	0.0000	0.0000	4.90	4.34
27.500	305.50	0.99999	0.0000	0.0000	4.90	3.53
22.500	310.50	0.99999	0.0000	0.0000	4.90	2.71
17.500	315.50	0.99999	0.0000	0.0000	4.90	2.00
12.500	320.50	0.99999	0.0000	0.0000	4.90	2.00
7.500	325.50	0.99999	0.0000	0.0000	4.90	2.00
2.500	330.50	0.99999	0.0000	0.0000	4.90	2.00



98.00	235.00	+	*	D
93.00	240.00	+	*	D
88.00	245.00	+	*	D
83.00	250.00	+	*	D
78.00	255.00	+	*	D
73.00	260.00	+	*	D
68.00	265.00	+	*	D
63.00	270.00	+	*	D
58.00	275.00	+	*	D
53.00	280.00	+	*	D
48.00	285.00	+	*	D
43.00	290.00	+	*	D
38.00	295.00	+	*	D
33.00	300.00	+	*	D
28.00	305.00	+	*	D
23.00	310.00	+	*	D
18.00	315.00	+	*	D
13.00	320.00	+	*	D
8.00	325.00	+	*	D
3.00	330.00	+	*	D

	I-----I-----I-----I-----I-----I-----I-----I-----I-----I
	0.99800 0.99900 1.00000 1.00100 1.00200 1.00300 1.00400 1.00500 1.00600
1.00700	1.00800
DENSITY G/CC	

COUGAR LAKE SEPTEMBER 25, 1996 SELECT

INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR

UNITS ARE IN FEET

WEIR CREST ELEVATION 155.000

WEIR LENGTH 100.000

DISCHARGE, VOLUME FLOW PER SEC. 25.0000

TOTAL DISCHARGE, VOLUME PER SEC 25.0000

LOWER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM
154.697 ELEVATION 154.697
LOWER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM
154.697 ELEVATION 154.697
UPPER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM
333.000 ELEVATION 333.000
UPPER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM
333.000 ELEVATION 333.000
OUTFLOW DENSITY 0.99960 G/CC
OUTFLOW TEMPERATURE 10.15
OUTFLOW CONCENTRATION OF TOTAL CARBON 0.66

Elevation	Depth	Density	Norm. Vel.	Flow	Temperature	Total Org. C
331.500	1.50	0.99887	0.0000	0.0000	16.60	0.60
327.500	5.50	0.99887	0.0548	0.0491	16.60	0.60
322.500	10.50	0.99887	0.1080	0.0968	16.60	0.60
317.500	15.50	0.99888	0.1691	0.1515	16.56	0.60
312.500	20.50	0.99889	0.2336	0.2092	16.50	0.60
307.500	25.50	0.99889	0.2807	0.2515	16.50	0.60
302.500	30.50	0.99889	0.3264	0.2923	16.50	0.60
297.500	35.50	0.99890	0.3785	0.3390	16.46	0.59
292.500	40.50	0.99894	0.4683	0.4195	16.18	0.58
287.500	45.50	0.99909	0.6328	0.5668	15.27	0.56
282.500	50.50	0.99915	0.7065	0.6328	14.85	0.55
277.500	55.50	0.99919	0.7553	0.6766	14.56	0.53
272.500	60.50	0.99922	0.7892	0.7069	14.38	0.52
267.500	65.50	0.99923	0.8118	0.7271	14.30	0.50
262.500	70.50	0.99925	0.8374	0.7501	14.15	0.50
257.500	75.50	0.99928	0.8631	0.7731	13.95	0.50
252.500	80.50	0.99931	0.8852	0.7929	13.75	0.50
247.500	85.50	0.99933	0.9025	0.8084	13.59	0.50
242.500	90.50	0.99935	0.9178	0.8221	13.44	0.50
237.500	95.50	0.99937	0.9312	0.8341	13.29	0.50
232.500	100.50	0.99940	0.9444	0.8460	13.07	0.52
227.500	105.50	0.99944	0.9578	0.8580	12.74	0.56
222.500	110.50	0.99950	0.9713	0.8700	12.21	0.61
217.500	115.50	0.99965	0.9880	0.8850	10.83	0.66
212.500	120.50	0.99981	0.9970	0.8931	9.04	0.70
207.500	125.50	0.99992	0.9996	0.8954	7.22	0.75
202.500	130.50	0.99996	0.9999	0.8957	6.24	0.79
197.500	135.50	0.99998	1.0000	0.8957	5.70	0.80
192.500	140.50	0.99998	1.0000	0.8957	5.46	0.80

187.500	145.50	0.99998	1.0000	0.8957	5.40	0.80
182.500	150.50	0.99998	1.0000	0.8957	5.40	0.80
177.500	155.50	0.99999	1.0000	0.8957	5.33	0.80
172.500	160.50	0.99999	1.0000	0.8957	5.30	0.80
167.500	165.50	0.99999	1.0000	0.8957	5.28	0.80
162.500	170.50	0.99999	1.0000	0.8957	5.20	0.80
157.500	175.50	0.99999	1.0000	0.8957	5.20	0.80
152.500	180.50	0.99999	1.0000	0.8957	5.15	0.80
147.500	185.50	0.99999	0.0000	0.0000	5.10	0.80
142.500	190.50	0.99999	0.0000	0.0000	5.10	0.80
137.500	195.50	0.99999	0.0000	0.0000	5.07	0.80
132.500	200.50	0.99999	0.0000	0.0000	5.05	0.80
127.500	205.50	0.99999	0.0000	0.0000	5.02	0.80
122.500	210.50	0.99999	0.0000	0.0000	5.00	0.80
117.500	215.50	0.99999	0.0000	0.0000	5.00	0.80
112.500	220.50	0.99999	0.0000	0.0000	5.00	0.80
107.500	225.50	0.99999	0.0000	0.0000	5.00	0.80
102.500	230.50	0.99999	0.0000	0.0000	5.00	0.80
97.500	235.50	0.99999	0.0000	0.0000	5.00	0.80
92.500	240.50	0.99999	0.0000	0.0000	4.98	0.80
87.500	245.50	0.99999	0.0000	0.0000	4.95	0.80
82.500	250.50	0.99999	0.0000	0.0000	4.93	0.80
77.500	255.50	0.99999	0.0000	0.0000	4.90	0.80
72.500	260.50	0.99999	0.0000	0.0000	4.90	0.80
67.500	265.50	0.99999	0.0000	0.0000	4.90	0.80
62.500	270.50	0.99999	0.0000	0.0000	4.90	0.82
57.500	275.50	0.99999	0.0000	0.0000	4.90	0.87
52.500	280.50	0.99999	0.0000	0.0000	4.90	0.93
47.500	285.50	0.99999	0.0000	0.0000	4.90	0.99
42.500	290.50	0.99999	0.0000	0.0000	4.90	1.05
37.500	295.50	0.99999	0.0000	0.0000	4.90	1.10
32.500	300.50	0.99999	0.0000	0.0000	4.90	1.10
27.500	305.50	0.99999	0.0000	0.0000	4.90	1.10
22.500	310.50	0.99999	0.0000	0.0000	4.90	1.10
17.500	315.50	0.99999	0.0000	0.0000	4.90	1.10
12.500	320.50	0.99999	0.0000	0.0000	4.90	1.10
7.500	325.50	0.99999	0.0000	0.0000	4.90	1.10
2.500	330.50	0.99999	0.0000	0.0000	4.90	1.10

COUGAR LAKE SEPTEMBER 25, 1996 SELECT

INPUT/OUTPUT USING RUSH CREEK CREST AS SUBMERGED WEIR

UNITS ARE IN FEET

WEIR CREST ELEVATION 155.000

WEIR LENGTH 100.000

DISCHARGE, VOLUME FLOW PER SEC. 25.0000

TOTAL DISCHARGE, VOLUME PER SEC 25.0000

LOWER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM

154.697 ELEVATION 154.697

LOWER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM

154.697 ELEVATION 154.697

UPPER WITHDRAWAL LIMIT (ACTUAL) HEIGHT ABOVE BOTTOM

333.000 ELEVATION 333.000

UPPER WITHDRAWAL LIMIT (THEORETICAL) HEIGHT ABOVE BOTTOM

333.000 ELEVATION 333.000

OUTFLOW DENSITY 0.99960 G/CC

OUTFLOW TEMPERATURE 10.15

OUTFLOW CONCENTRATION OF DISSOLVED ORCARB 0.57

Elevation	Depth	Density	Norm. Vel.	Flow	Temperature	Diss. Org. C
331.500	1.50	0.99887	0.0000	0.0000	16.60	0.60
327.500	5.50	0.99887	0.0548	0.0491	16.60	0.58
322.500	10.50	0.99887	0.1080	0.0968	16.60	0.57
317.500	15.50	0.99888	0.1691	0.1515	16.56	0.55
312.500	20.50	0.99889	0.2336	0.2092	16.50	0.54
307.500	25.50	0.99889	0.2807	0.2515	16.50	0.52
302.500	30.50	0.99889	0.3264	0.2923	16.50	0.51
297.500	35.50	0.99890	0.3785	0.3390	16.46	0.49
292.500	40.50	0.99894	0.4683	0.4195	16.18	0.48
287.500	45.50	0.99909	0.6328	0.5668	15.27	0.46
282.500	50.50	0.99915	0.7065	0.6328	14.85	0.45
277.500	55.50	0.99919	0.7553	0.6766	14.56	0.43
272.500	60.50	0.99922	0.7892	0.7069	14.38	0.42
267.500	65.50	0.99923	0.8118	0.7271	14.30	0.40
262.500	70.50	0.99925	0.8374	0.7501	14.15	0.39
257.500	75.50	0.99928	0.8631	0.7731	13.95	0.37
252.500	80.50	0.99931	0.8852	0.7929	13.75	0.35
247.500	85.50	0.99933	0.9025	0.8084	13.59	0.34
242.500	90.50	0.99935	0.9178	0.8221	13.44	0.32
237.500	95.50	0.99937	0.9312	0.8341	13.29	0.31
232.500	100.50	0.99940	0.9444	0.8460	13.07	0.33
227.500	105.50	0.99944	0.9578	0.8580	12.74	0.41
222.500	110.50	0.99950	0.9713	0.8700	12.21	0.48
217.500	115.50	0.99965	0.9880	0.8850	10.83	0.56
212.500	120.50	0.99981	0.9970	0.8931	9.04	0.64
207.500	125.50	0.99992	0.9996	0.8954	7.22	0.71
202.500	130.50	0.99996	0.9999	0.8957	6.24	0.79
197.500	135.50	0.99998	1.0000	0.8957	5.70	0.79

192.500	140.50	0.99998	1.0000	0.8957	5.46	0.77
187.500	145.50	0.99998	1.0000	0.8957	5.40	0.76
182.500	150.50	0.99998	1.0000	0.8957	5.40	0.74
177.500	155.50	0.99999	1.0000	0.8957	5.33	0.73
172.500	160.50	0.99999	1.0000	0.8957	5.30	0.71
167.500	165.50	0.99999	1.0000	0.8957	5.28	0.71
162.500	170.50	0.99999	1.0000	0.8957	5.20	0.73
157.500	175.50	0.99999	1.0000	0.8957	5.20	0.75
152.500	180.50	0.99999	1.0000	0.8957	5.15	0.77
147.500	185.50	0.99999	0.0000	0.0000	5.10	0.79
142.500	190.50	0.99999	0.0000	0.0000	5.10	0.82
137.500	195.50	0.99999	0.0000	0.0000	5.07	0.84
132.500	200.50	0.99999	0.0000	0.0000	5.05	0.86
127.500	205.50	0.99999	0.0000	0.0000	5.02	0.88
122.500	210.50	0.99999	0.0000	0.0000	5.00	0.90
117.500	215.50	0.99999	0.0000	0.0000	5.00	0.90
112.500	220.50	0.99999	0.0000	0.0000	5.00	0.90
107.500	225.50	0.99999	0.0000	0.0000	5.00	0.90
102.500	230.50	0.99999	0.0000	0.0000	5.00	0.90
97.500	235.50	0.99999	0.0000	0.0000	5.00	0.90
92.500	240.50	0.99999	0.0000	0.0000	4.98	0.89
87.500	245.50	0.99999	0.0000	0.0000	4.95	0.87
82.500	250.50	0.99999	0.0000	0.0000	4.93	0.86
77.500	255.50	0.99999	0.0000	0.0000	4.90	0.84
72.500	260.50	0.99999	0.0000	0.0000	4.90	0.83
67.500	265.50	0.99999	0.0000	0.0000	4.90	0.81
62.500	270.50	0.99999	0.0000	0.0000	4.90	0.81
57.500	275.50	0.99999	0.0000	0.0000	4.90	0.85
52.500	280.50	0.99999	0.0000	0.0000	4.90	0.89
47.500	285.50	0.99999	0.0000	0.0000	4.90	0.93
42.500	290.50	0.99999	0.0000	0.0000	4.90	0.96
37.500	295.50	0.99999	0.0000	0.0000	4.90	1.00
32.500	300.50	0.99999	0.0000	0.0000	4.90	1.00
27.500	305.50	0.99999	0.0000	0.0000	4.90	1.00
22.500	310.50	0.99999	0.0000	0.0000	4.90	1.00
17.500	315.50	0.99999	0.0000	0.0000	4.90	1.00
12.500	320.50	0.99999	0.0000	0.0000	4.90	1.00
7.500	325.50	0.99999	0.0000	0.0000	4.90	1.00
2.500	330.50	0.99999	0.0000	0.0000	4.90	1.00

REPORT DOCUMENTATION PAGE

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		5b. GRANT NUMBER
		5c. PROGRAM ELEMENT NUMBER
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		5e. TASK NUMBER
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13. SUPPLEMENTARY NOTES

14. ABSTRACT Blue River and Cougar Reservoirs are proposed for modification to their withdrawal structures to allow selective withdrawal. The purpose of the proposed modifications is to improve downstream temperatures for the coldwater fishery in the McKenzie River. The Corps committed to study water quality at the reservoirs to predict downstream impacts to water quality in the McKenzie River as a result of selective withdrawal. Proposed modifications to the project structures at Blue River and Cougar Lakes will result in release of warmer surface water during the spring and summer. Assuming that the current limnological structure of the lake is maintained, the present absence of strong chemical trends is unlikely to result in future increases in outflow chemical concentrations. Indeed, turbid releases may be decreased or postponed until later in the season during the release of the deeper water. The chemical trends that exist tend toward greater concentrations with depth. Surface releases may improve the water quality in these outflows.
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(Continued)

SUBJECT TERMS Limnology, Reservoir, River, SELECT Model, Temperature, Water Quality					
SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES 216	19a. NAME OF RESPONSIBLE PERSON
REPORT UNCLASSIFIED	b. ABSTRACT	c. THIS PAGE UNCLASSIFIED			19b. TELEPHONE NUMBER (include area code)

14. ABSTRACT (Concluded)

Proposed modifications will alter the processes contributing to many of the above conditions. The limiting resource for much of the biological activity is the element nitrogen (N) which is also important for many other limnological characteristics. Because of its biological importance, nitrogen metabolism in this system is also important to the water quality effects of the proposed structural modifications.

Water quality concerns which remain regarding the proposed structural modifications are: (a) the unknown extent to which additional particulate organic material may be released from the lakes; (b) the late summer fate of accumulated nutrients in the hypolimnion of the lakes; (c) the additional changes that may occur as a result of increased retention of deeper waters, the turbid materials they contain, the increased hypoxia that can occur, and the potential response of biota when these become available during mixing or during late summer releases.

Although these concerns remain, factors that may mitigate their effect include the fact that much of this response will occur during the late summer when the lake is drawn down and depending on intake design, such waters may be diminished during drawdown. The maximum extent to which these processes may occur does not likely exceed the observed present deep hypolimnion conditions in Cougar Lake. Indeed, the submerged ridge associated with Rush Creed currently provides a model of the likely behavior of Cougar Lake after modification and further changes in water quality as a result of intake modifications may be quite small.